FREDERICK WINSLOW TAYLOR

FREDERICK WINSLOW TAYLOR

A Memorial Volume

BEING ADDRESSES DELIVERED AT THE FUNERAL OF FREDERICK WINSLOW TAYLOR, CEDRON, INDIAN QUEEN LANE, GERMANTOWN, PHILADELPHIA, PA., MARCH 24, 1915; AT A MEMORIAL MEETING HELD UNDER THE AUSPICES OF THE SOCIETY TO PROMOTE THE SCIENCE OF MANAGEMENT (NOW TAYLOR SOCIETY), UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA, PA., OCTOBER 22, 1915; AND AT MR. TAYLOR'S HOME "BOXLY," CHESTNUT HILL, PHILADELPHIA, PA., OCTOBER 23, 1915.

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Of this book there has been printed an edition of one hundred copies, of which this copy is No. . . . . In accordance with the primary purpose of the publication, fifty copies have been deposited in the principal public libraries and libraries of engineering societies of the United States and of foreign countries.

CONTENTS

ADDRESSES

AT MR. TAYLOR'S FUNERAL, CEDRON, INDIAN QUEEN LANE, GERMANTOWN, PHILADELPHIA, PA., MARCH 24, 1915

BY JAMES MAPES DODGE

FREDERICK WINSLOW TAYLOR was a prophet with honor in his own country and, at the same time, honored and respected in every civilized country of the globe. He was a devoted husband and faithful friend, modest and considerate; he was a remarkable student, an inventor of the first rank and an engineer of resource and keen perception, indefatigable in his work and unswerving in his devotion to truth. With a remarkable combination of temperament and learning he became the bearer of a message that is destined to make him recognized the world over as the emancipator of the worker and of the employer. He delivered the worker from the oppressive burdens of the old order and gave him freedom to win the best for his family and himself. He delivered the employer from the necessity of being only a task-master and gave him the opportunity to be the friend and co-worker of those associated with him.

Through his scientific investigations of the relations between employer and employee he was able to formulate a system which made it possible for both parties to realize that their interests instead of being in irreconcilable conflict were identical and that they were interdependent, and that all questions between them could be settled by kindness, forbearance, and patient investigation without resort

to mistrust, suspicion, or antagonism. He was the bearer of the only flag of truce that was ever carried upon the battlefield of industrial strife. Ignorance and prejudice have fired upon this flag, but it was never lowered, and now that the hand that carried it must relinquish its noble office, thousands of others will sustain it in its exalted position, and I predict that it will never be lowered and that the employer and the employee will both prosper under it as they have never prospered before, and with increasing respect, regard, and solicitude for each other's welfare.

Many others have prayed for an industrial social millennium, expecting it to come from spiritual grace through lapse of time, but Dr. Taylor not only saw the possibilities of the future, but he did more: he told in detail exactly how this long-hoped-for condition might be actually accomplished at once. The seed he has sown is springing up in thousands of places; the message he gave us is making hundreds, yes, even thousands of converts; the work he so ably started, being based upon eternal truth, will partake of the lasting characteristics of its foundation.

BY MORRIS LLEWELLYN COOKE

SO much stress has been put upon the practical accomplishments of Frederick W. Taylor that the great reach and sweep of his spirit has, except for the few, been almost submerged. All his lifetime of patient, tireless investigation; all the acuteness of his highly scientific mind; all the aspirations of a sensitive nature, were bent on the one end — of making human life a better thing to live. To this object he made the freest possible sacrifice of his fortune, his time, and his health.

The strength of the great movement which Mr. Taylor originated lay very largely in the devotion which we in the ranks felt for our leader. We rarely thought to call him a great man — it seemed like such a surface observation to anyone who ever saw him at work. But we were always conscious of his incessant struggle — of the long weary years of battling to make men have faith in themselves.

He had a wonderful capacity for friendliness — a capacity that could stretch across seven seas, and last a lifetime, and reach the lowest man in the ranks. He taught us our mutual dependence and then proceeded to carry nearly all the load. He tinged all our work with ideality. Hear his own words, "I can no longer afford to work for money"; "All our inventions and changes are made to produce human happiness;" "In all your relations, do

to the other fellow what you would have him do to you." Just a year ago, Father Sertilanges, preaching in Paris, said: "The love of God is the Taylor System of our inner life (l'amour de Dieu est le systeme Taylor de notre vie interieure)." Mr. Taylor made us feel that there is nothing we cannot accomplish — and this without hurting our fellowmen.

Those of us who are gathered here this afternoon are only representative of a large army of men and women to whom the principles of Scientific Management as practiced and taught by Mr. Taylor have made a compelling appeal. In every part of the world — in the mines of Mozambique, in far-off Japan, and among each of the contending armies on the Continent, and all over this country — were those who called him "Master." Standing beside the body of our fallen leader, I wish I could convey even the slightest suggestion of what his inspiration has been to his followers and what a calamity has come to them — as to the world — in his death. I wish that to you and through you who are here I could issue a call that would seal the solidarity of this movement for the bettering of human relations in business and industry, for which Mr. Taylor gave his life.

If we could only lose ourselves as he lost himself in his love of humanity! If we could only have the supreme confidence in the final outcome which he never lost! If we could only care as little as he cared about being numbered with the crowd, when the crowd was wrong! And above all, if we could only act as if we believed that industry and national

prosperity and life itself are complicated problems, not to be solved by any easy formulas, but worthy of the closest scientific scrutiny, the most patient and untiring investigations, the highest ideality that the human mind and spirit can bring to bear upon them! This is the glory of Frederick W. Taylor's life and this is the heritage he leaves for those who believed in him — who followed him — who loved him.

It was a part of the greatness of Mr. Taylor that he was not altogether concerned about the world's understanding of the greatness of his principles and motives. His loyal friends would do well to keep in mind his own words: "Patience, patience, and then more patience." His ideas forged ahead primarily because they were true and because they fitted in with the spirit of the time. But Taylor's "hanging on with his teeth," as he expressed it, and his willingness to stand alone when he was right, made them prevail.

Clean cut in his vision and keen in his judgment, fearless of criticism or misunderstanding, Frederick W. Taylor rang true in every act. He thought straight and spoke his mind with no uncertain sound and his speaking cleared the air of sophistries and evasions. No man who was ever honored by his friendship, sustained by his counsel, upheld by his invincible spirit, can ever willingly set himself an easy task or be unwilling to tread the difficult way — so it be straight and clear.

Perhaps it is true that this great pioneer in a search for fundamental laws underlying human relations in industry had to die before the world

could grasp and appropriate the spiritual significance of his ideas. But let us never for a moment think of his genius as resting from its labors. The torch he kindled he has passed on to other hands to carry forward in the world of men. But it is impossible not to believe that already his eager curiosity, his undimmed mentality, his splendid enthusiasm, are engaged in a new and spiritual adventure, for which his training and discipline were a fitting preparation. No more baffled by human limitations within and without, his passionate search for truth given a universal field and scope, his horizon bounded only by the stars, Frederick W. Taylor will always lead us by the inspiration of his continuing life, the comradeship of his undying spirit.

"Bid him awake from the dream, the probation, the prelude,
to find himself set
Clear and safe in new light and new life — a new harmony
yet
To be run, and continued, and ended —
Who knows?"

ADDRESSES

AT THE MEMORIAL MEETING, HOUSTON HALL,
UNIVERSITY OF PENNSYLVANIA,
PHILADELPHIA, PA.,
OCTOBER 22, 1915

The Officers and Members
of
The Society to Promote the Science of Management
request your presence
at a meeting to be held in memory of

Frederick Winslow Taylor

on Friday evening, October twenty-second
at eight o'clock
Houston Hall, University of Pennsylvania

Speakers

Rudolph Blankenburg
Mayor of Philadelphia

Edgar Fahs Smith
Provost of University of Penna.

Carl G. Barth

Henry L. Gantt

Louis D. Brandeis

Harlow S. Person

James M. Dodge

Sanford E. Thompson

Honorary Vice Presidents

Clarence M. Clark

Henri le Chatelier

Morris L. Cooke

Wilfred Lewis

William Crozier, U.S.A.

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Edwin F. Gay

Hans Renold

C. F. Goodrich, U.S.N.

Ida M. Tarbell

H. K. Hathaway

Sanford E. Thompson

Y. Hoshino

Henry R. Towne

Toro Ishiki

A. Wallichs

BY HARLOW STAFFORD PERSON

MR. PROVOST:

ON behalf of the Society to Promote the Science of Management[1] I thank you for this welcome, and through you the University of Pennsylvania for its cordial hospitality. It is peculiarly fitting that the Society should hold this memorial meeting in this environment,— in Pennsylvania, in the city of Philadelphia, under the roof of a great university. In this state, because within its borders Mr. Taylor saw his great problem, and through nearly half a century devoted himself to its solution. In this city, because here he later made his home, and here his body rests. In this city, furthermore, because into its records have been indelibly written, that all may read, the most perfect application of his philosophy of management to efficient municipal administration. Under the roof of a great university, because in purpose, in method, in temperament, he represented all for which a university stands. He was investigator and seeker after truth; he was discoverer and formulator of truth; he was jealous guardian of truth; he was teacher and leader of men.

Because of the prejudice developed by their environment, educators in estimating men like to test

[1] [Now named Taylor Society, in honor of Frederick Winslow Taylor. — ED.]

them for these characteristics. It is a joy to have found them in Mr. Taylor. That is the source of the inspiration which has prompted educators to associate ourselves with this Society for the purpose of preserving and developing the principles discovered by him, and for the purpose of convincing every man of their fundamental soundness and value to society. As an investigative and educational personality this Society is a lineal descendant of Mr. Taylor, investigator and educator.

Mr. Taylor embodied the highest ideals of the most exacting university, — an unquenchable passion to learn the truth; an indefatigable energy and persistence in the search for it; a command of the essential intellectual and physical apparatus of investigation; an imagination which penetrated the darkness ahead; and a modesty which forbade the common sin of premature announcement of results.

It was a quarter of a century after Mr. Taylor first conceived the first principles of his philosophy of management before he announced them in the memorable address before the American Society of Mechanical Engineers. To some of us, one of the most heroic acts in the history of science was Charles Darwin's modesty and patience in long and quiet investigation which preceded the announcement of epoch-making discoveries. The story of it thrills us. Likewise we are thrilled when we realize that we have been associated with and now continue the work of a man who has shown a similar example of supreme modesty and patience.

Again, Mr. Provost, on behalf of the Society, I thank you and the University for its cordial welcome.

BY RUDOLPH BLANKENBURG

MAYOR OF PHILADELPHIA

THE greatest tribute I can perhaps pay to the memory of Mr. Taylor is to advise you that soon after my election as Mayor of Philadelphia, four years ago, I requested him to call upon me. He did so, and at my house we discussed all phases of city government and what would best serve the City of Philadelphia during the new administration.

After fully discussing this important question, I asked him to make a great sacrifice for the public by accepting the position of Director of the Department of Public Works. He seemed pleased, but hesitated, stating that he did not see how he could do so. When I saw him again, a day or two later, he said, "It would be a real pleasure for me to accept your offer so as to help you in the great work of regenerating Philadelphia, but it is impossible for me to do so on account of my health. I have really more to do now than should be asked of any man, and it is a physical impossibility for me to add to my work."

But Mr. Taylor helped me after all. When I looked further for a man to fill the important position of Director of Public Works, Mr. Taylor helped me in the selection and recommended to me one of

his disciples. I appointed that disciple as Director, and he has made good and is an honor to the City of Philadelphia.

Mr. Taylor was to me a paradox. On one hand we find his rugged intellect blasting its way up through layer after layer of conventions formed by generations of prejudice, tradition, and ignorance until he became recognized as perhaps the world's foremost industrial leader. When truth was at stake, he was resourceful, robust, and tireless. The problem once even dimly visioned he pursued with the zest of a hunter until he conquered.

On the other hand, those whose contacts with him were, like my own, only casual and who went to him as converts, rather than to be converted, could hardly sense his power. He was born and bred to a gentle manner. His sweet smile and courtly bearing were only the surface indications of an innate and broad-spreading sympathy and kindliness. He knew he had much to give and he gave it with a generosity which knew no limits. Yet few men of this or any other time had sensed so clearly how much there is to be known and what a short way we have gone on the journey.

We in Philadelphia who saw Mr. Taylor come and go among us as our friend and neighbor only dimly comprehend — if at all — that the world has been listening to his teachings for years as to one of the master minds of his time. The Japanese, the French, and those of Scandinavian lands were among the peoples who have read his books in their own tongues for years. The industrial scientists of Germany, Italy, and Russia have crossed the sea

with the beautiful home of Boxly as the end of their pilgrimage.

Today his fellow-townsmen are alive to the significance of his mission, and an eagerness to acquaint ourselves with his methods and principles is springing up in all our hearts.[1]

This war-torn world of ours has indeed lost a great leader at a time when it needs him most. It would seem that when the moment comes to bind up humanity's wounds, the creed which Mr. Taylor lived and died to establish may prove one rock on which we may build a more lasting peace.

The City of Philadelphia is indeed proud of his genius and even more proud of the great service he rendered to mankind.

While we may some day erect monuments in marble or bronze to his memory, Frederick Winslow Taylor has erected for himself, in the city of his birth, an imperishable memorial in the great work which he has woven into the fabric of our institutions.

[1] Mayor Blankenburg then read abstracts from papers sent for the occasion by Mr. Charles Freminville of Paris, France, and Professor A. Wallichs of the Royal Polytechnic School of Aix-la-Chapelle, Germany, both of which are printed in full in these proceedings.

HOW HAVE I KNOWN FREDERICK W. TAYLOR; WHY HAVE I ENDEAVORED TO POPULARIZE SCIENTIFIC MANAGEMENT?[1]

BY HENRI LE CHATELIER

FREDERICK W. TAYLOR is a mechanician and I am a chemist: he is an engineer, and I am a professor. What has brought us in touch with each other? How have I been led to undertake the popularizing of industrial methods, which is quite outside of my province? Some will say it is chance, — the veriest accident. But, in the Taylor System there is no room for chance; all facts are necessarily related to each other. The very object of this system is to disentangle the inevitable relations of phenomena. Chance has to do only with those relations of which we are still ignorant. The questions which I raise here give very clear proof of the correctness of this definition of chance. If the bringing together, across the Atlantic Ocean, of two scholars entirely unknown to each other seems at first sight inexplicable, the following statement will demonstrate, on the contrary, that it was inevitable and that chance had nothing to do with it.

I have devoted my life to the study of science, and in pursuit of this study I have allowed myself

[1] Read by Col. Vignol, Military Attaché of the French Embassy, and special delegate to the memorial meeting by appointment of the President of France.

to be guided by a few leading principles borrowed from the philosophical works of Taine. To my mind the end of science is simply the study of the relations existing between phenomena; that is to say, the study of natural laws. Moreover, a sound method for the study of these laws consists in at once directing all one's efforts toward the analysis of the most important factors; that is, of those which play a preponderant part in the determination of a given result.

Being, moreover, a professor in a polytechnic school, I naturally had to interest myself from the very first in the elements of industrial progress; in my opinion science is the dominating factor therein. In order to develop the influence of science in French industry, and to make our engineers understand the beneficial rôle of scientific methods of work, I established *La Revue de Metallurgie* about fifteen years ago. In this publication I proposed to give a leading place to the studies of industrial science, while giving ample space to purely technical information, which was necessary to insure the reading of my review by those manufacturers who are often but partially convinced of the practical value of science.

Faithful to these principles, in editing this review I was obliged systematically to give a conspicuous place to the dominating facts,—to allot the number of pages devoted to each industrial process, according to its real importance. At the time of the Paris Exposition in 1900, struck by the evident importance of high-speed tool steel, I reviewed systematically all the articles bearing on this discovery in order to give extracts from them in *La Revue*

de Metallurgie. I published among other things an extract from a lecture of a Sheffield engineer, Mr. Gledhill, attributing the discovery of high-speed tool steel to a lucky chance. A careless workman had overheated one of his tools and, far from damaging it, he had considerably improved it. This incident coming to the knowledge of two industrial engineers, Messrs. Taylor and White, had given birth to high-speed tool steel. Not believing in chance, I had followed up this article with some personal remarks, saying that it had certainly required a high order of scientific observation and investigation on the part of the engineers in question to have been able to draw such an important discovery from the carelessness of a workman. This article fell under the eye of Frederick Taylor. Some months afterwards when he decided to publish the history of his discovery in his celebrated presidential address to the mechanical engineers, "The Art of Cutting Metals," he sent me a copy of the final proofs, thanking me for my words of appreciation. It might interest me, he said, to know that chance, as I had foreseen, had had absolutely nothing to do in the discovery of high-speed tool steel.

I then asked Mr. Taylor to authorize my publishing a French translation of his paper, which he very obligingly granted. But, he added in his letter, he believed that he had done something much more important than his work on cutting metals, namely, his scientific management of shop work. He asked me to read attentively his paper called "Shop Management" and to give him my criticism of it.

I knew the work in question very well by name, but I thought that it treated simply of a system of paying wages, the differential system, more or less similar to Halsley's system of premiums, which had not seemed to me sufficiently interesting to make me buy the book and read it. Once in possession of this volume, I studied it conscientiously and I was profoundly surprised to find in it a very remarkable application of the scientific method to industrial problems. In undertaking the publication of *La Revue de Metallurgie*, I had proposed to generalize the applications of science to industry, but I had not understood the full extent of the domain of science. I had hardly dreamed beyond the introduction of the laboratory and of its experimental methods in factories, but I had not foreseen the possibility of extending the domain of science over all the realm of industry, including questions of organization, commercial questions, labor questions, etc.

I was somewhat ashamed to find the science of a practical man infinitely more developed (*élevée*) than my own. From that day on I felt myself obliged, in order to remain faithful to the program which I had from the first mapped out for myself, to constitute myself an apostle of the Taylor System. From the beginning I was perfectly aware of the difficulties and of the time which the spread of the new ideas would require. It had already been hard enough to induce manufacturers to make use of laboratories, even when the material results were tangible and paid immediately. It would be still more difficult to make them accept a more complex

method of work, more costly to put in operation and, above all, giving only more remote results. Calling to mind, then, this other principle of Taine, that to convince people it is not sufficient to give them good reasons, but that above all you must fire their imaginations by a series of individual facts which they can easily digest and which all lead to the same end, I made up my mind, either in *La Revue de Metallurgie* or in other publications, to come back incessantly to the advantages of Taylor's Scientific Management. A nail is finally driven home by the constant repetition of little blows. It was in this way that an active correspondence with Frederick Taylor was brought about and the beginning of those sentiments of friendship arose which made his premature death particularly painful to me. We shall endeavor at least to make his ideas live and to awaken the feeling of gratitude to which he is entitled because of the beneficent work he left behind him.

After all, the bond which inevitably drew us together was the community of our scientific interests, directed alike toward industrial progress. We have, independently and without any acquaintance, come upon each other from different routes which led to the same end: we had to meet sooner or later. There was indeed no accident in the origin of our collaboration.

. . . . . .

Now, what has the result been, as far as France is concerned, of the efforts made to spread the Taylor System? It has been nothing, if one judges by appearances. There is not to my knowledge

a single one of our factories which has been entirely reorganized by the inspiration of the principles of scientific management. I know only half a dozen where partial applications have been attempted. Among these, the St. Jacques Factory at Monlucon, a branch of the Company of Chatillon, Commentry and Neuves House, is the most remarkable example to cite. This factory is directed by Mr. Charpy, an expert, and a correspondent of the Academy of Sciences, who had already begun to introduce scientific methods of work in his factories before he knew of Frederick Taylor's publications, which only encouraged him to persevere in the path in which he had been walking. On the other hand, there has certainly been brought about a widespread stimulation of ideas in the industrial world; I know of it by the many letters that I have received. Moreover, it is possible to give even more direct proof of this. The French translation of the "Principles of Scientific Management," has been printed in two editions to the number of 8000 copies, of which 3000 have been gratuitously distributed and 4000 sold — representing, then, at least 5000 readers. To-day Frederick Taylor's ideas are familiar to the majority of French engineers: whether they will or no, these necessarily exercise an influence on every one of their decisions. But the name of Taylor is not spoken on that account, and it hardly ever will be, because his ideas can never be applied in our industry until they have passed into the spirit of other engineers and have become their very own.

The advice of consulting engineers, which is considered so natural in the United States, does not

obtain with us. To reorganize a factory you appeal to one of Taylor's disciples — Barth, Gantt, Thompson, etc., or to one of their imitators. With us, on the contrary, a factory insists on reorganizing itself only with the help of its own staff, and on invoking no name except that of the firm. I had warned Frederick Taylor that in France his system would take the name of the engineers or the firms which would put his ideas into practice. "I desire nothing more," said he; "so that my ideas spread, it matters little the dress under which they circulate."

If French engineers have studied the ideas of Frederick Taylor with interest and sympathy, it has not always been so with workmen and especially with labor unions. However, their opposition has been less active than one would have feared and especially it has generally been half-hearted. The greatest difficulties on the part of workmen came about because certain shops, in spite of the explicit recommendations of Frederick Taylor, chose to apply only a few of the principles of Scientific Management, selecting those which seemed to them the most advantageous.

I have had in my own hands letters from workingmen complaining very justly that they had been forced to increase the speed in running their machine tools, receiving the bonus promised by Taylor — but that the precautions had been neglected which were necessary to insure an increased supply of materials commensurate with the increase of the production of the machines. They were thus forced to lie idle from time to time, for an hour or more,

and in spite of the higher wages per hour, they did not make any more per day than they had before.

The statements about the Taylor System issued by the leaders of the labor unions have disagreed considerably — some of them have frankly taken the defensive, as has Founière, in a series of articles published in the *Depêche de Toulouse*. Others have declared that the Taylor System was excellent in itself, and that there would be no objection to it, if the employers were not brigands and did not attempt to use this method as a weapon against the workingman. Finally, some of them, like Puget, have shown themselves to be decidedly antagonistic to new methods of work, but, in order to combat them, they have used arguments in absolute bad faith. For example, they cited an alleged quotation of an English journalist named Frazer, making him say in his book "America at Work," that all workingmen working under scientific management reached the cemetery before coming of age. Now there is nothing of the kind in the volume in question. Frazer does not mention anywhere the scientific method of Mr. Taylor, the existence of which he does not suspect. His invective is aimed at a large manufacturing plant in Philadelphia whose principles of administration are really the very negative of those of scientific management. In this shop the rule is to choose for each operation the most capable man, and then to let him do the best he can, without tying him down to any principle of management. In France, the most earnest opponents of the Taylor System are perhaps the economists. That may seem surprising, but on second thought one understands

why scholars discussing industrial questions which are altogether out of their province, without ever having set foot in a machine shop, must in the nature of things conform their ideas in their criticisms to previous opinions and to systems established by long tradition. They do not dare to launch out into new fields whose foundations they are not able personally to appreciate. Be that as it may, Frederick Taylor's ideas are making their way little by little. Machinery was forced upon industry in spite of the attacks of which it was the object; it will be the same with the scientific principles of management of work. From certain points of view their success would be even easier, because ideas have a far greater force of penetration and of diffusion than material objects. One can break up machinery, burn down shops, but there is no way of coercing ideas.

THE RESPONSE OF FRANCE TO SCIENTIFIC MANAGEMENT

BY CHARLES DE FREMINVILLE

THE associates of Frederick Winslow Taylor, gathered together to perpetuate his memory, have, in asking me to present a few remarks on the work of their master, conferred on me a great honor, to which I had no right to aspire.

I shall endeavor, however, to invoke the uprightness, the energy, and the elevation of character of the eminent man who gave me such a cordial welcome. At the same time I wish to point out, from the point of view of the engineer, how Frederick W. Taylor's ideas were presented in France; with what sympathetic interest they were received; and how great a service they are called upon to render to the French. Those ideas acquaint them at the most opportune moment with a method of organization which appeals to them more than any other, because, depending, in spite of what has been said, on the development of the individual, it responds perfectly to their own aspirations.

When Frederick Taylor's works "On the Art of Cutting Metals" and "Shop Management" appeared, they attracted the particular attention of a learned engineer whose name is universally recognized, M. Henri le Chatelier, because they represented the most remarkable application of the

scientific method to industrial work, and the finest development of that industrial science towards which M. le Chatelier himself was already striving to lead the way. Through his interest these important works were first published by *La Revue de Métallurgie*.

The method used involved such determination and continuity of effort, such close coöperation for an unprecedented length of time, and laws carried out to such a fine point, that it was difficult to think it was not exaggerated.

But from the moment I heard of this great work it was easy for me to recognize in it the development of those experiments in the cutting of metals which had been pointed out to me at the time of a visit to the shops of William Sellers in 1885 and which could not have been published until a much later date. I was able then to bear my humble witness to the work of Frederick Taylor.

Nevertheless, when the works of Frederick Taylor were published in France, the name of the great engineer must have already been known there, for it was that of one of the inventors of the high-speed tool steel which had made such a great sensation at the Paris Exposition in 1900. Everyone knew then that this great discovery was the result of the scientifically exact experiments conducted right in the shops with remarkable method and perseverance by Frederick Taylor and his associates. Such a demonstration could not pass unnoticed. Not only did Taylor reveal himself as an observer beyond the ordinary — but he taught others how to observe; he showed the extent of the field which opens up

before trained observation and he should be recognized, without argument, as the head of a new School of Observation.

"On the Art of Cutting Metals" had been published with "Shop Management" by M. le Chatelier. The volume passed from hand to hand, and after having commanded the attention of manufacturers, of the directors of railroad companies, etc., it reached the managers of the shops and the foremen, who were struck by the practical advice, based on a profound knowledge of the world of labor, which they met in every line.

From that moment Frederick Taylor acquired in France the right of citizenship, and the assimilation of his ideas and of his method was only a question of time.

If Frederick Taylor had awakened the interest of experts by the application he had made of the scientific method, the manufacturers and their associates had recognized a master in him and did not allow him to be reduced again to the rank of the inventor of a system of industrial control.

It may be said that the French, thereby following their natural bent and conforming to their traditions, will be more and more drawn to Frederick Taylor's ideas because of the ideal that inspires them and of the fact that Mr. Taylor, in showing how the scientific method can be made accessible and put within reach of a great many fellow laborers for the development of a vast and fertile field, responds to a very real need in the French character.

"Method" has long been honored in France. It characterizes the spirit which the great technical

schools endeavor to inculcate in their pupils and which has contributed not a little to their ability to occupy an extremely important place in industry. It is the men who have gone out from these schools who have, for more than a century, superintended the building of the scientifically planned bridges which are found everywhere spanning the rivers of France. The discoveries or applications of science, made by their successors, do not count more. It is useless to enumerate them here — for America, which does not have to borrow any laurels from others, is the country in which one most often hears homage rendered to the discoveries of French science. Suffice it to say that it is thanks to these men that the French railroads were able a year ago to accomplish the mobilization of troops with a precision which so much astonished Americans. It is to them that France owes her artillery; and it is the spirit of "method" with which they are imbued which has put them at the head of our armies. If the pupils of these schools have occasionally brought upon themselves the reproach of wishing to introduce "method," with its uncompromising exactitude into a realm which, some assert, does not admit of its application and which they designate by the name of "practice," it is because they themselves have not had sufficient faith in "method" to pursue the application to its logical conclusion.

These men are the first to admit this and to acknowledge that Mr. Taylor, in developing "method" in industrial operations much farther than anyone had dared to conceive of doing before, has established "the missing link" for which they sought.

They do not see a "system" in Frederick Taylor's work (although it is generally so designated in France) but a remarkable extension of the application of "method."

The French workman himself was not the last to understand how Taylor obtained such astounding results in the working of metals. Long since accustomed to associate the names of scholars with great industrial discoveries, he willingly accords to them the admiration and respect due to extraordinary men, and frequently experiences a lively desire to contribute, however little it may be, to their work. "Never mind," he has said more than once to himself, after having applied himself very methodically to his task, "I have done a little like Taylor." So it is not surprising that the seekers after precedents have explored France with the greatest care, in the hope of finding the germ of Mr. Taylor's ideas there. But they have been obliged to admit that they found themselves in the presence of a new work. If they happened to discover that some of the finest geniuses of French mechanics, such as Bélidor, Vauban, Coulomb, had paused for a few moments to analyze the motions of the workman and had left a few notes on the subject, there was still no connection between these notes and the labors of Frederick Taylor. Not only were these labors not minimized by these great men, but they received brilliant tributes from them.

Frederick Taylor is not, however, content with teaching how to observe: he wishes to show how to act. He proves that most industrial tasks involve incredible losses of energy, — that they are not co-

ordinated, except by altogether insufficient plans for them as a whole. The workman is not trained: he is not directed: his work results in goods of such varying quality as to be unworthy of the time in which we live.

Routine rules supreme in the shop. It often engenders systematic loafing and, at other times, overwork. Order must be installed, and to that end fixed rules for the management of the work must be adopted, from the top to the bottom of the scale. This is what one cannot get people to admit, without the greatest difficulty. Moreover all organization which assures the effective coöperation of the separate elements contributing to management is often sufficient to insure the success of a business. Minute study of the motions executed during a task in itself makes it possible to perfect the habits which constitute the power of the workman. And the breaking up of the work into elements easily grouped together is the only way to establish a fair price for this task, leaving no room for any errors by either party. These elements of work have been very properly compared, by one of Mr. Taylor's associates, to the letters of our phonetic alphabet. Why not make use of them, instead of continuing to try to make estimates which are completely lacking in exactness, and which may be likened to the endless symbolic characters of the Chinese?

It has been said that many people would rather die than pause one moment in their work to reflect on what they are doing. How many others uselessly waste their precious time and strength constantly reinventing what they ought to have

learned once and for all? A man rarely takes the trouble to notice what is under his eye; not even what is pointed out to him. The simplest observation, such as is apparently within reach of everybody, has little attraction for him. He is continually asking himself why all that he sees is not better done, and his one idea is to improve everything. So there were not lacking innovators anxious to make use of the work of Frederick Taylor in improving things. They found themselves face to face with a man who had a horror of compromise and was unwilling to distort the principles which he had enunciated. Above all did Taylor consider that it was a waste of time to formulate elementary principles already established. A professor does not ask his pupils constantly to reaffirm the rules of grammar. Why should a man hesitate to adopt those rules which govern the employment of all his time and strength and the activities of all his life,— rules in reality much more sensible than those rules of grammar which make it possible for the average man to express himself correctly?

Habit and environment have made the most complicated rules instinctive. Why would it not be the same with those which have to do with coördinating the movements of the workman? All this ought not to be constantly the subject of argument. It ought not to have to be rediscovered.

Frederick Taylor generously said that if he sacrificed his tastes, which inclined him towards the study of mechanics, in order to accomplish a task very often monotonous in spite of its great importance, it was in the hope that by so doing he would

at least make it possible for others to devote themselves entirely to the development of their natural inclination instead of having continually to begin over again what he had already done.

This is the kind of education of a man which Frederick Taylor took upon himself. It is a task which has always been a thankless one, and which is rendered more or less arduous by the particular mentality of those whom it addresses.

The mentality of men varies according to country and is all the more difficult to define as each one is made up of contradictions. It is generally admitted that the Frenchman is little concerned about the exclusive ownership of what he has created and that he has frequently neglected to exploit his finest inventions, contenting himself with having labored for humanity. He is, however, possessed with a fierce individualism in anything that concerns his personal liberty.

It might be said that he never alienates himself from himself, but waits until this constraint is put upon him from without. It is rarely that he lends himself to long collaboration.

The American, who seems to us to place much more emphasis on keeping in his own hands what he considers to be his own property, whose motto is "Mind your own business," knows, however, how to coöperate with others, how to organize a partnership, and he is willing to make sacrifices to that end.

To a Frenchman, the work of Frederick Taylor is indeed a development of American genius, characterized by an elevated feeling for the individual. Here we find again the effort of the man accustomed

to depending on himself alone, especially on his own energy and perseverance, constantly taking most minute inventory of his personal resources — the least as well as the greatest — and improving them in order, with the coöperation of his associates, to exploit them.

Frederick Taylor teaches his countrymen how to make tremendous progress in the path which is natural to them, by pointing out to them how much trained habits increase the efficiency of a man, and hence his personal value; and he makes an appeal to the confidence Americans have in their own ability, to enthuse them to utilize their efforts in the shop as rationally and logically as they are careful to use them on their own account.

Again it is to American energy that Mr. Taylor's indefatigable efforts to call attention to his ideas and to establish them must be ascribed. Taylor's ideas have seemed to be revolutionary to some Americans. To a Frenchman they were born and have developed in the very environment in which they should naturally be born and developed, *i.e.*, in the country of Benjamin Franklin.

Taylor gives a lesson of the greatest importance to the French in acquainting them with a type of organization which applies equally to individual and to collective organization, making it possible for them to make the best of their natural resources.

Frederick Taylor liked France and would have liked to be of use to her. For the too brief hours during which we were together, we happened upon a maritime laboratory, on the coast of Brittany, born of the most modest beginnings and sheltering

for several years the joint labors of fishermen and scientists. Discoveries of the greatest importance had been made here with the most rudimentary material, but they had brought very little honor to their authors. The most elementary of their valuable findings were hardly taken advantage of. For instance, when they investigated matters of public interest such as public health, they brought upon themselves endless trouble.

They consoled themselves with reading the accounts of the application made in distant countries, of their discoveries, and on such a colossal scale as to be almost incredible. Frederick Taylor must have made more than one reflection when visiting this laboratory. At any rate he had the pleasure of being able to say to his hosts that there was no exaggeration in what they had read, and that their discoveries had been made the object of the most important application.

Frederick Taylor found there a graphic example of a fact which had been pointed out to him again and again. What he saw excited his enthusiasm but also his desire to help France to derive more practical advantage from the discoveries she was able to make. He was full of hope on this subject, for he could see how completely his ideas had found an echo in France, and how serious were the efforts already made to put them into practice. And so during the last sojourn he made in our midst, in one of those addresses in which one would seek in vain for a word of flattery, he did not hesitate to salute in France the country which offered the finest future for the application of his methods.

The movement then launched, which seemed so full of promise, has been arrested by the war, but already France is thinking of the future, and of the necessity, greater than ever before, of undertaking a systematic organization of her resources and of her work.

The "Kultur" imposed by a despotic power will always be a horror to the French people, but they will gladly accept a method — a plan — which encourages the development of individuality, laying its foundation on its individuality and giving it consciousness from its power. This is what they will find in following the path indicated by Frederick Taylor. And so it is towards him that many eyes are turning to-day.

Frederick Taylor presented his works in the simplest possible form without attempting to attract any attention to himself and without asking himself whether the reader would care to penetrate his personality. His associates have told me from the first how dependable was his friendship, so I may be permitted to recall the impression which he made on a stranger who had the good fortune to pass several hours with him, first in his accustomed environment and then in France, in altogether different and greatly varied surroundings.

Frederick Taylor was an observer of exceptional penetration, but his work is witness to the fact that he was indeed one of those men, rare in any country, who from the beginning of their careers subordinated all their actions to a high and perfectly definite purpose. No one has ever done so with more energy or determination. In full command of this masterly

trait of scientific observation which he possessed in such high degree, he continually directed it towards a definite end. Never did he allow his imagination to bewilder his observations, or to alter their exactness. They all bear the trace of absolute sincerity.

Again we detect the same integrity when he is concerned with the application of his ideas to the organization of labor. He is not afraid of provoking contradiction and he did not welcome that approbation which is so dangerous and which drowns the idea by returning it to that void from which it had been delivered.

Taylor possessed a deep lofty mind, embracing a widely extended field of activity. If he gave himself particularly to the task of making people understand the efficacy of his method for the better utilization of material resources and of the everyday activities; if it pleased him to show, with rare ability, that this method could be applied as well to agriculture as to mechanics or to sports, he knew how to raise himself above his work itself in order to affirm that the use of the means which he recommended must cease with the material world. And it is no exaggeration to say, that in struggling against the waste of energy and time which constantly accompanies not only industrial labor but also that of everyday life, he strives to make a larger place for the intellectual life.

His conception of spiritual endeavors was very high. Avoiding a too common confusion, he established an absolute distinction between the work of the workman and that of the artist. He knew enough to recognize that an artist worthy of the name must

always fear to imprint the trace of simply manual or physical habits on his work, although the skill of the workman is the result of this same methodical development of such habits.

Frederick Taylor regarded spiritual things with great respect. He was deeply touched when he learned that one of the most authoritative voices of the French pulpit, in a daring comparison, had not been afraid to define "the Love of God" as "the Taylor System of our inner life."

The man of genius is not frightened by the greatness of the task which he undertakes, and troubles himself little about the profit which he ought to get out of it, for it is a small task indeed whose materialization does not exceed the life of an individual.

Inevitably Frederick Taylor could not have put in the complete development of the movement which he had begun, but he was able to see that the roots were already very deep, and that a brilliant future opened up before him.

His last days were, however, to be greatly saddened. After having devoted his life to the betterment of material conditions and to the raising of the standard, he had to witness the most abominable use which man has ever made of his resources. When I saw Taylor in Philadelphia on the eve of this terrible war, he recognized perfectly the importance of the preparations made by the Germans and he saw, better than anyone else, perhaps, what kind of war it would be that would set them in motion. But he refused to believe that a man capable of unchaining them could exist.

This is, however, what happened. The letter which he wrote me at that time showed me what a shock he had received. He could not free his mind from that scene of horror, and it may be believed that this obsession hastened his end and that Frederick Winslow Taylor was a victim of modern barbarism.

WHAT DO THE GERMANS THINK OF TAYLOR?

BY PROFESSOR A. WALLICHS

THE character and significance of the Taylor doctrine have been accepted by the German people only in part, both because the time for making clear, either orally or in writing, Taylor's meaning has been too short, and because we here are just at the beginning of its practical application. Nevertheless I cherish the definite hope that in the near future the true value of Taylor's efforts will be more thoroughly comprehended and appreciated by a large number of the German people. The essence of the doctrine, namely, "To better the conditions of the laboring classes and to increase the general pleasure in work," must certainly find in the German people fertile ground for development. This is especially true, because in Germany the demand for a means to settle social inequalities is becoming steadily stronger, and the earnest purpose to get together in the pursuit of a common goal is beginning to ripen among ever larger sections of both labor and capital.

Taylor did not grow tired of pleading with both sides: "Your interests are, for the most part, not hostile, but identical." And he did not content himself with words alone: he had *proven* the truth of his doctrine in practice before he proclaimed it.

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In that lies, as I see it, the immense value of his work. The world has had enough of the profound opinions of learned economists and philosophers as to human happiness. Taylor, however, did not give his propositions publicity until after he had by hard work and incessant struggle thoroughly tested the possibility of carrying them out. In his classic "Shop Management" he declares repeatedly that "nothing is so convincing as bringing to pass actual results."

The remarkable thoroughness in the execution of his work, his consideration of all the circumstances, — whether or not they had hitherto seemed insignificant, — his perseverance in the pursuit of his aims, must and will find ultimate recognition on the part of the German people. Economists, German engineers, and scholars who understand the true essence of the Taylor doctrines have, almost without exception, become his disciples. Among these we find men of distinguished reputation such as Bathenau, Kammerer, Schlesinger, Hempel, Oswald and others. Naturally the Taylor principles are most widespread in the ranks of engineers and industrial managers. Among these are few indeed who do not know at least the name of the Taylor System; another group, forming the majority, has a superficial knowledge of the character of the Taylor doctrine; and a group of German engineers, of by no means least importance to-day, has acquired a thorough understanding in all respects of the great lifework of Mr. Taylor. Among these last one finds unreserved appreciation, while the critics are found more among those who have only a superficial knowledge of the

tem. This fact is the best recognition of the rectness and practical value of Taylor's principles. A small group of German scholars and manufacturers, immediately after the publication of ylor's basic works, "Shop Management" and n the Art of Cutting Metals," recognized their reaching significance. So it seemed to the writer worthy task to make Taylor's books useful to a er circle of German engineers by translating m into German. It is worthy of note that the er work, "On the Art of Cutting Metals," met h greater appreciation than "Shop Management." e reason for this may be found in the fact that latter book dealt with experiments and proper- of steel and so brought into prominence valu- discoveries in the difficult problem of the proper duction of high-speed steel, with the result that ple were eager to utilize this knowledge in the tal-working shops. This book aroused the great- interest in manufacturing circles as well as ong scientists. The minuteness of detail, thor- hness, and uncommonly logical method of Tay- s work, overcoming all difficulties, called forth undivided admiration. Indeed, the procedure adopted by Taylor to solve the difficult problem the regular production of high-speed steel may didly be designated as *classic*. The efforts of ineers and scientists all over the world to at- n results in similar lines had led to no results, ause they had failed to investigate each variable, which Taylor names twelve, individually, while ding the others constant. Taylor was the first to succeed in a comprehensive plan. He showed

how experiments *must be conducted in the workshop with genuine scientific thoroughness and proper sequence* in order to obtain practical results. By this Taylor has rendered to industry as well as to science inestimable service. It might be further emphasized that the great significance of Taylor's writings was recognized simultaneously by engineers and scientists. I need but mention the names of Neuhaus and Schlesinger.

After the favorable receptoin which the German edition of this book, On the Art of Cutting Metals," had met in Germany, it was clear that Taylor's basic work entitled "Shop Management" could not long be withheld from German engineering circles, The writer, therefore, undertook at once this task, with all the greater zeal because after careful study he found it a treasure house of great truths in the difficult art of management and *especially in the treatment of the workmen.* Taylor recognized that the often asserted antagonism of the interests of employer and employee need not exist with proper management and treatment; that rather there exists a mutual interest in the success of the enterprise, and that this same interest can well be united with a higher wage and more humane treatment of the worker. With remarkable insight he devised ways and means to save unnecessary loss of time, yet without the necessity of overworking the operatives. He recognized the significance in their bearing on the final result of all the circumstances hitherto considered merely incidental. The small things and the seemingly insignificant he found worthy of exhaustive investigation; and just because

they hitherto had been neglected, these incidentals offered so much room for improvement that the result of the aggregate was amazingly beneficial. No one had suspected how much time actually had been lost by unnecessary motions and faulty arrangement. Taylor shed light in every nook and corner of the daily routine, and examined everything in the effort for well-planned use of time. *His ability to grasp things fully and with keen perseverance to draw from the knowledge attained its practical application, together with his wonderful knowledge of men and his true love for humanity, enabled him to win a success which has aroused the astonishment and admiration of the world.*

I now turn to the question, "In what measure thus far have results been obtained in Germany by the application of the Taylor principles?"

In some places very noteworthy beginnings have been made. In many places there exists the "earnest intention" to gain the economic and social advantages resulting from the use of the new doctrine. However, success in the sense of favorable or unfavorable economic influencing of results in industry in general presupposes a longer existence of the new system. But we cannot yet speak of this, for a general dissemination of this new theory in the economic circles of this country has taken place only within the last two years, in spite of the publication in German of the basic Taylor writings, as far back as the beginning of 1909. If, therefore, I can report but little of our experiences in Germany with "scientific management" (as the Taylor doctrine has justly been termed of late), I may never-

theless treat the subject somewhat more broadly with respect to our domestic industries and speak of the probable effect on our social and economic life, to be expected from the general introduction of the new system. In Germany it is about the same with scientific management as with many inventions in technique. German industry takes up new ideas much more slowly than foreign industries, but it soon far surpasses them in development and scope because it undertakes the experimentation and complete working out with genuine German scientific thoroughness and perseverance. When I first became acquainted with Taylor's doctrine, I was surprised that these ideas originated in America and not in Germany, because the admirable thoroughness, the great perseverance with which Taylor pursued his goal, the almost arbitrary rules covering all apparently unimportant details and processes, the analyzing and observing one by one of all the activities and motions, are phenomena which are more characteristic of the German than of the American people.

This fact established, the many objections to the possibility of a general introduction of Taylor's scientific management in German industries are removed. For the reasons already stated, it is admirably suited for our conditions, that is to say, the application of these principles as such; not, however, the wholesale transplanting of all the regulations and mechanisms, as employed in any particular one or another of the shops organized by Taylor in the United States. To be sure, these give us the key and the main outlines how to proceed,

but by no means the absolutely binding directions for its application. We are not to *introduce* this new system, but to *develop* it point by point, in accordance with our own conditions. We should proceed according to genuine scientific method, not empirically; we must try to find the existing laws in both mechanical processes and handwork, and on these as a basis, build up standards and laws covering how and with what aids the work is to be done.

The reasons which hinder a rapid and extended application of Taylor's doctrine lie not in the limitations of the field but in the *lack of trained forces* to guide its introduction, and partly also in the weakness of human nature among the managers. The self-esteem of many of these gentlemen is hurt by the thought that processes discovered and developed by others should be better than their own kind of management worked out through decades of struggle and strife, in many cases with successful results. They oppose it, therefore, chiefly because they fail to recognize the superiority of new methods. Many assert that they have long since recognized and adopted to a large extent the principles developed by Taylor. They also consider that Taylor's control of the smallest elements, going beyond anything they undertake in their own organization, is superfluous hair-splitting. Where these conceptions have taken root, they undoubtedly work against the spread of scientific management, since the better is always the enemy of the good. Nor can it be disputed that at least a part of these assertions are correct. We know of numerous organizations in most branches of our industries, which have achieved

phenomenal success because of their well regulated and fairly well executed planning of work; but *no one* had proven or even suspected that thorough scientific observation of all, even the minutest and seemingly most insignificant processes, would result in such significant reductions in the time and effort of work. No one else has shown Taylor's perseverance in *carrying through* a well-defined logical program. Still less have our managers perceived the importance of the coöperation of the workers for obtaining the greatest economy. The social aspects of his success are not sufficiently recognized. Taylor himself places them above the purely technical features. Just a short time ago he expressed himself clearly on this subject to a German visitor. His words follow:

"These plans for reducing the cost of production will be improved and surpassed by others, primarily through machine technique and also through better ideas of organization; of all these things which to-day we claim as the best obtainable, not one will remain.

"But one thing will and must remain, and that is the basic idea which guided me, from the very beginning, in all my work; namely, the fundamental recognition which alone carries us forward:

"THE EARNEST AND HONEST EFFORT FOR IMPROVED RELATIONS BETWEEN EMPLOYER AND EMPLOYEE, THE STRIVING TO ABOLISH THE ANTAGONISM BETWEEN THESE TWO FACTIONS — TO THIS WE MUST STEADFASTLY HOLD."

Such words prove that Taylor sees, in social progress, his greatest success.

To judge by the numerous statements which have come to me from managers, I cannot conclude that the large majority of these men deny the superiority of Taylor's ideas over established conceptions. We have a sufficient number of men who, free from an exaggerated idea of their own success, wish to make the most of the economic value of this new doctrine. But more difficult to meet is the above mentioned lack of organizers trained in Taylor's ideas. For the improvement of this condition, both public and private bodies should coöperate in the interests of industry and, through special courses of instruction and trips to the United States for study, take steps to build up a suitable force of teachers.

The systematic training of organizers is quite essential for the following reasons. The development of scientific management must be undertaken in the factories without disturbance and along with the regular routine work, by a special organizer, not by the manager of the plant. The manager has neither the time nor the thorough knowledge to carry out all the details of study in accordance with the prescribed regulations. The introduction of such a new task requires, therefore, considerable additional work, which primarily has little to do with the process of production; step by step after preparation, the various departments of the shop undergo reorganization.

All the reports received from German industrial circles of initial experience during introduction are, almost without exception, favorable. As an example I append a report of a firm engaged in the wood industry in the Rhine district:

"The first test with Taylor's principles was made on a 'Fasson' lathe which turned out large quantities of wooden pieces for cabinet makers. A worker on this machine worked at piece work at the rate of three (3) pfennigs per meter, earning at his maximum capacity between 4 and 4.20 marks daily, accomplishing about 130 to 150 meters' work during the same working time. After time studies were taken with a stop watch, it proved that the actual working time was only one-fourth of the total time and that the rest of the time was lost through the sharpening of tools, setting up, repairing of belts, bringing of the material, etc.

"We introduced, first of all, tools of *high-speed steel* instead of the ordinary kind hitherto used; we replaced the existing bronze bearings with ball bearings, and the ordinary belts with best quality leather belts. The result was remarkable. Although the worker was transferred from piece work to day work based on his average daily earnings, he easily produced 300 meters daily. After the introduction of a premium system, based on his daily wage, in a short time he ran up to 400 meters daily. Through further time studies it was then established that the forward and backward run of the machine which heretofore had been done by the workman, could be done automatically, and that during the backward run the next piece of material could be brought up by the workman. The result of these further improvements is the present daily production of at least 550 meters and average earning of about 5 marks daily for young workers from 17 to 18 years of age, while formerly adults, working to the

limit of their endurance, could earn only 4.20 marks.

"As we did not simply pocket as profit the advantage in production so obtained, but reduced correspondingly the selling price, there resulted immediately an increased volume of sales, so that not only was no reduction in working force necessary, but on the contrary, the installation of a second and then a third Fasson lathe.

"To the above mentioned favorable result was added the circumstance that, according to Taylor's doctrine, we took the Fasson lathes at once away from the supervision of the general foreman, and instead we established a functional foreman, whose only duty was to provide the raw material and set up the machines. The above result shows how this unproductive labor paid for itself."

This report is in many respects very instructive. It shows that in a plant excellently managed according to ordinary standards, studies made in a small auxiliary department under the inspiration of Taylor's works, and changes made on the basis of these studies, have resulted in surprisingly large economies for the business, and in essentially increased earnings for the workman; this, too, without taking any steps to change the entire organization through especially trained organizers. Naturally in this plant further studies and adjustments will follow until, in the course of years, it can be said that in all respects the standardization of the working processes has been completed. The report shows that where the determination for improvement exists, former shortcomings are quickly found. Without

exaggeration one can maintain that in all plants like successes in individual cases can be obtained.

Another report lies before me, from the repair shop of a chemical plant in the south of Germany. Here, to be sure, the work was done by one of the few organizers now living in Germany, who had been trained in one of the Taylor plants in the United States. The success here was in an altogether different field; while in the former instance the improvements were limited principally to an improvement in method for a work chiefly mechanical, in the chemical plant the success was achieved *exclusively by a strictly supervised preparation and division of the tasks to be done by the repair workers*, employed mainly on handwork. A work order in the Taylor sense, heretofore considered impossible, was introduced. This gave to each workman each day a task defined in writing and with only one possible interpretation as to time, nature, and extent. At the same time order in keeping of stores was established according to the Taylor methods. Even in the first year after the introduction, the yearly losses in stores were greatly decreased, and the amount of work accomplished was greatly increased. Great economies were already effected, without any change in the wage system. As is known, Taylor and his followers have obtained the greatest increase in production through changing the wage system in such a way that the workman, on accomplishing the tasks in the prescribed time, receives a considerable increase in wage.

The workmen pay no attention to the time limit if the incentive of increased wages does not impel

them to it. The use of such wage systems as increase the desire to accomplish the task can, however, be successful only when a strictly regulated scheduling of order of work, of moving of material, and of maintenance of standards, etc., has been put through. So far as I know, no plant in Germany has yet reached this stage; but from previous observations I do not doubt that we shall ultimately do so. In one department of a large Berlin machine shop the men no longer object as they have heretofore to the exact measurement by the stop watch of the working time of the best workmen for the purpose of determining a just piece rate. They have recognized this method as just and, since the introduction of this strictly controlled management, they have drawn essentially higher wages, averaging 90 pfennigs per hour. Of course the stop watch can be used only openly for the measuring of the working time, any underhanded methods being rightly subject to deep mistrust. And you must not call it the "Taylor System," the worker's press having frequently warned against this system and the workers themselves repeatedly been urged to resist every attempt at its introduction.

It will be seen, from these reports, that Taylor's ideas have found fertile ground here in Germany. The great European war has been an obstacle in the development of this as in so many other relations. Nevertheless, I am fully convinced that after peace is proclaimed, which, let us hope, will be soon, Taylor's stimulation will be felt again in Germany with redoubled force — to bless a favorable economic development and to better the lot of the workman.

APPRECIATION OF MR. FREDERICK W. TAYLOR

BY PROFESSOR J. J. SEDERHOLM

THE most memorable event during my three months traveling in North America was undoubtedly my meeting with Mr. Taylor. It was so, both because I personally admired him so much, and because I think that his teachings are exactly what we want in my country, Finland.

I can add nothing to the characteristics of his personality, and should I speak of the kindness with which he offered me his help, I should have only to describe what all of his friends have experienced. Let me therefore restrict myself to considering what benefit my own country may be expected to reap from his influence.

As is well known, the struggle for existence between the nations of Europe is very keen both politically and economically. The small nations in particular are forced to strain all their efforts in order not to be overwhelmed or left behind.

It is therefore simply a necessity for us to learn from every nation, appropriating the best which they have to offer. Personally I think that we have especially much to learn from the United States. Of this I may mention an instance, rather trivial in itself, but significant. When our sportsmen formed the ambitious plan that Finland should beat

at the last Olympian games, as many of the other countries as possible, they took their training methods from America. The result was that little Finland became the fourth country of the world in this international sporting contest, ranking next to the United States, Sweden, and England, and beating Germany, France and other large countries.

Now I think that in all kinds of human industry we also ought to learn from the Americans how to "go ahead," hoping for a similar success if we do so.

The Taylor System is to Europe not only "an American lesson," it is *the* American lesson. It is true that I have read in a foreign newspaper an article about it, full of misrepresentations, in which it was styled "false Americanism." To me, on the contrary, it is the *very essence of good Americanism.*

We have, in most countries of Europe, enough of strong and industrious laborers, but much work is here going on with an exasperating inefficiency. Remember that Finland lies in the same latitude as Greenland, a circumstance which accounts sufficiently for a good deal of dullness. When our people go to America, they are stimulated and work very differently, but when they return it is not long before they revert to earlier habits.

The Taylor System enables us to introduce American briskness in every field of human industry in Europe.

In my youth I read, with much pleasure, the book of Laboulaye, "Paris in America." Now we want another thing, which might be properly called "Philadelphia in Europe." Every workshop in Europe where the Taylor methods are introduced is like a

little Taylor-Philadelphia, an American colony, founded by the followers of Mr. Taylor.

There we will learn how to work with American quickness and efficiency. But, as is well known, the Taylor System is not at all a method of "speeding up." It is a system of working intelligently, with spared effort, and it offers to everybody taking part in the work advantages unheard of before. Therefore, every "Philadelphia in Europe" may also, in accordance with the literal meaning of the name of the Quaker City, be called a "fraternity," a "brother loving community." Every workshop where the Taylor System is used is a place where men work in harmony, in conjoint effort, to mutual benefit, and more intelligently than ever before.

This we regard to be the great discovery of Mr. Taylor, that he has found the necessity of using much more brains than before in managing industries and, in general, all human work. His scheme seems to be as simple and obvious as the famous egg of Columbus, but it is, however, in most fields an innovation.

Last winter when I was alternately lecturing on the Taylor System and the Evolution of the Animal World, I was struck by a curious analogy. In the history of the earth, it was only at a late date that nature discovered the usefulness of large brains. The monster reptiles of the Mesozoic era had only minute brains in their gigantic bodies. Still at the eve of the Tertiary era mammals with the size of our cattle had brains as small as a walnut, and it was not until the end of that era that the brains attained their present size. This development reached

its climax in Man, *Homo Sapiens*, the animal with brains, who, on account of his intellect, became the master of the earth.

Industry has still to learn the same lesson. It has not yet advanced beyond the Mesozoic stage, but the time will soon come when people will regard shops without a planning department of sufficient size, shops where hundreds of laborers are managed by half a dozen of engineers and foremen, with the same wonder as is felt by us when we look at the skeleton of a *Diplodocus Carnegie* with its gigantic body and almost microscopical brain. And when that time arrives, then everybody will also recognize the greatness of Frederick Winslow Taylor, the discoverer of the simple truth that large brains are necessary in industries and, in general, for managing all kinds of human labor.

BY CARL G. BARTH

WHILE I made Mr. Taylor's personal acquaintance at least as far back as the year 1884, while working for William Sellers & Co. of this city as a draftsman, and as such occasionally had to do with the working up of some of his ideas for the improvement of machine tools, it was not until the summer of the year 1899 that I became associated with him at the works of the Bethlehem Steel Co., an association which continued uninterruptedly until his death, nearly sixteen years.

But while therefore, abstractly, in a better position than anybody else to give an account of his work and influence during this period of his life, I am by temperament, and by lack of education along certain lines, anything but fitted for such a task in a manner befitting an occasion like this. Besides, the time allotted is too short for this. What I can say will therefore be of a fragmentary nature only, and principally intended to give a little insight into Mr. Taylor's great character, as I learned to view it in my association with him.

When Mr. Taylor began the original work that finally culminated in a complete system of scientific management for industrial establishments, he had no idea of what he was steering towards. The difficulties that first beset him in his career as a leader of men, led him to believe that most of them

would disappear if he could find some scientific way of predetermining the time it should take to do a given piece of work in a machine tool, such as a lathe or a planer. However, it took him and his several associates a period of some eighteen years before this problem was even theoretically solved to his satisfaction, and still, odd as it seems, the solution effected is to-day almost forgotten, in view of the many other problems that beset the management of an industrial institution, for which Mr. Taylor has also offered such eminently satisfactory solutions along scientific lines.

However, when I joined Mr. Taylor at Bethlehem, it was for the express purpose of assisting him in the solution of this, his original pet problem; and I shall never forget the intense delight evinced by Mr. Taylor on the morning of a certain day when I was able to hand him an empirical mathematical formula representing the results obtained by a set of experiments made in metal cutting with high-speed tools of his and Mr. White's renowned make, which was at once recognized as the beginning of a better way of attacking the problem than anything previously brought to light.

The fact that the work was not his own did not in the least detract from his satisfaction. Great soul that he was, it did not matter to him whence the solution came, — his efforts for so many years seemed finally likely of being crowned with success, and that was all he cared for.

It was a few months later that the final solution of this problem enabled Mr. Taylor's task system, in conjunction with Mr. Gantt's bonus, as a substi-

tute for Mr. Taylor's differential piece rates, to be instituted at Bethlehem. Inside of a comparatively short time this led to that most astonishing increase in production, which at the time was the wonder of all visitors to the works, and which was partly due to the high speed tools, and partly to the scientific methods employed in their use on machines that had been rebuilt and respeeded to meet the new conditions, in connection with the reward to the workmen who properly coöperated in the whole matter.

My first visit with Mr. Taylor at Bethlehem for the purpose of discussing a possible engagement happened to be on a day that certain yard laborers, who were to be put on piece rates, threatened to strike. Word to that effect reached Mr. Taylor during our interview, but while it is impossible to believe that it did not inwardly affect him, he did not betray the slightest perturbance and completed his interview with me as if nothing had happened. I will add that I learned later that the strike did not take place.

While Mr. Taylor at times was a very exacting master, and at all times demanded that every subordinate do his full duty, he was also so high minded that he readily took a reprimand from a subordinate. I shall thus never forget the fine manner in which he once took a most rude reminder from myself, and I cannot refrain from the temptation to tell the story.

I was in his office waiting for his attention, when a captain of the army, who was stationed at Bethlehem as head inspector for the Ordnance Department, brought in a certain colonel from the Watervliet Arsenal, to renew a former acquaintance with Mr.

Taylor. All three gentlemen were enthusiastic golfers, so that the conversation soon turned to this subject, which was kept up, not only until the colonel had been escorted to his carriage, but long after Mr. Taylor and the captain had returned to the office, where by this time some three other subordinates, besides myself, were waiting to see Mr. Taylor. I finally got so impatient that I broke in on the two gentlemen with a: "Hang your golf talk, gentlemen, it has lasted long enough. I am here to do business and want attention."

The effect of this was about the same as a thunderbolt from a clear sky, and sent the captain out of the door and Mr. Taylor back to his desk, where I sat down with him to transact the business in hand. Before starting in, however, I felt that a humble apology for my extreme rudeness was in order, but Mr. Taylor waived it aside by a most kindly pat on my back, at the same time saying, "Mr. Barth, it is all right. There are times when it is a subordinate's duty to call a superior's attention to his duty, and that is all you did." I can recall a number of superiors I have had in the past, that would have all but fired me, if they had been in Mr. Taylor's place.

Perhaps the greatest lesson taught some of us by Mr. Taylor, is the value of confidence in general principles and general experiences.

I have thus never forgotten the absolute confidence with which he some twelve years ago assured a certain prominent manufacturer that the recent favorable reports the latter had received about greatly improved conditions in a plant in another city in which he was interested, could not represent

the facts; it would, he said, in the very nature of the conditions that were known to have existed there a few months earlier, take almost as many years to bring about the alleged improvements. This subsequently proved to be the case.

His faith in scientific methods and the immutableness of natural laws and general principles, he only shared, of course, with numberless scientists of his day, but as a practical engineer and manager he had had experiences that do not come within the range of the professional scientist.

Another of Mr. Taylor's most striking characteristics was his great appreciation of those of his superiors of former times who had taught him valuable lessons. For some of those he did not entertain a high general regard, — but with a fine discrimination he would laud the good he had seen in them, and draw his lesson from it. And as regards seeing the good in other people, the development of his character, as I had the rare opportunity to notice it, resembled what I once heard a lecturer say about Abraham Lincoln. "His heart grew more and more tender as the years went by, until just before his death he was ever ready to see excuses for the behavior of even those of his disciples who were not as loyal as they might be to the great ideals for which he had worked so faithfully and disinterestedly."

Great was his work viewed from only the material side: greater, by far, were the ideals that prompted it, and which he left to sustain us, as they did him, through the numerous difficulties, large and small, which the practical continuation of his work carries with it.

BY HENRY L. GANTT

IT was my good fortune to be associated with Frederick Winslow Taylor when, as a young man, he was developing those characteristics that were to make him famous.

His reputation does not depend upon the fact that he designed and built the most successful big steam hammer in the world, or that he developed a method of treating tool steel that trebled its cutting power, or that he determined the laws of cutting metals, or even that he was the father of scientific management. These were incidents in his career, and only the logical results of his methods. At an early date he realized how much of the world's work was based on precedent or opinion, and undertook to base all his actions on knowledge and fact.

Endowed naturally with untiring energy and a wonderfully analytical mind, he concentrated all the power of that combination on the problem of determining the facts he needed. He was interested in what had been done mainly for the indication it gave of what could be done. His mind was continually on the future, and to him the great value of knowledge was that it enabled him to anticipate that future. Accurate in his calculations and logical in his conclusions, he never failed to put his trust in the results of his investigations, and often

accomplished what was considered by others to be impossible. Indeed it was those problems that had been given up by others as impossible of exact solution that it was his delight to attack, and it is surprising to how many of them he found that solution.

Balked at the outset of his career as foreman of the machine shop of the Midvale Steel Company by the lack of knowledge of cutting steel which then existed, he set himself the task of suppyling that lack. The first three years were spent in finding out how to study the problem; and, although the work was not completed for over twenty years, it is a fact that when I entered his employ in 1887 the fundamental laws had already been approximately determined. Subsequent investigations served to confirm what had been done and to correct minor inaccuracies.

At Bethlehem he became so interested in determining these laws exactly, that it is doubtful if he ever realized how wonderfully accurate his earlier results really were. To be sure, much more ground was covered in the subsequent work, but as an investigation into the laws of cutting metals, his work as a young man at the Midvale Steel Works stands out, to my mind, as far the more remarkable achievement. In his subsequent work he followed strictly the methods he had previously perfected.

One of the by-products of this investigation was the discovery of the Taylor-White process of treating high-speed steel, the far reaching effect of which has not only not yet been realized, but cannot be until all the other problems entering into machine

shop management have been given the same kind of study as has been given the cutting of metals.

The least heard of, but, to my mind, his most daring feat, was the design of the great hammer of the Midvale Steel Co., which kept its alignment by the elasticity of its parts which yielded to the force of a foul blow and returned exactly to their former position. Dependence upon the principle of elasticity enabled him to build a hammer which, for its weight, had far greater power than any other hammer that had ever been built. All previous hammers of this class had been designed to keep their alignment by great mass and stiffness, and it took a bold man to throw precedent aside when the stake was such a large one. I do not know of any more daring or successful piece of engineering construction.

The fact that he became a pioneer in another field is not surprising, for he was destined to be a leader in whatever field his activities took him.

It seems quite likely that if he had adhered to what was then known as strictly engineering, he would have made even a greater reputation than he achieved in the field of management.

The work by which he is best known, however, is not what was then regarded as strictly engineering. Strange as it may seem, although much knowledge and thought had been devoted to the design of machinery and apparatus, but little study had been given to the possibilities of the men who were to operate that machinery. Even to this day many engineers consider their work done when they have designed and built and demonstrated the possibilities of a piece of apparatus. They seem to feel

that the efficient operation of it is not in their province. Mr. Taylor felt otherwise. To him perfection in design was worthless without efficiency in operation, and at an early date he turned his attention to the efficient utilization of human effort.

In this work he used the same method that had already brought him success, namely, to disregard opinions, from whatever source, unless substantiated by facts. Where facts were not available, and they seldom were, he used the scientific method for their determination.

When I went to the Midvale Steel Works in 1887, he had already made considerable progress in this work, and had fully developed the methods of detail analysis and study which later became the origin of scientific management.

He recognized as an economic as well as an ethical fact, that the employer should always consider the interests of the employee. Endowed with vast energy and great ability to work, he recognized the advantage such qualities would be to others, and offered high wages to those who would develop them. That he was correct is shown by the remarkable success which has been attained by all who profited by his training.

If I were asked to point out his most prominent characteristic, I should say that it was his ability to prosecute the task he had set himself regardless of the lack of sympathy of his friends and the criticism of his enemies. Having determined on a course of action he pursued it regardless of consequences; and inasmuch as such courses were planned by a clear head and followed with an iron will, he often

accomplished results far in excess of what even his most earnest supporters thought possible.

To end here would not complete our picture. He was not the steam roller that some people like to represent him, but he did believe that a strenuous life was the life worth while, and that it not only brought more financial compensation, but that it added to the usefulness and happiness of men. He believed:

"That when the day is over and your work is all well done,
That when the campaign's ended, that when the battle's won,
Then friendship keen, and memory of many happy days
Bring the glorious satisfaction that a life of action pays."

He had still another side: People said he made work of his play. True, work was his joy. Not the routine that could be done by anybody, but the work that others had been unable to do. An unsolved problem was a constant challenge to him, and he attacked it with a thoroughness and an eagerness that it is hard to comprehend. The fact that for several years he continually worked at problems that brought him no financial return, is evidence that he had reached the stage when —

"We shall work for an age at a sitting,
And never be tired at all;
And no one shall work for money,
And no one shall work for fame;
But each for the joy of working.
And only the Master shall praise,
And only the Master shall blame."

STAGES BETWEEN MIDVALE AND BETHLEHEM

BY SANFORD E. THOMPSON

THERE stands out vividly in my mind an occasion some twenty-five years ago when a messenger pulled me out of bed at three o'clock one winter morning to go down to the pulp mill. I was met there by Mr. Taylor. "Mr. Thompson, I told you to have an idler built for every belt in this mill. Why was this not done? I don't want any excuses — I won't have any excuses — why wasn't it done?" This was one of my first lessons in the training which every man received who came under Mr. Taylor's direction in those days. Over and over again we would hear the requirement to "Get there. It doesn't make any difference how you get there, but get there." And again, "Don't wait for anything." And we marveled and still marvel how he could remember the numerous instructions he gave us all and call us to account in his extraordinarily emphatic manner for the least omission.

My personal friendship with Mr. Taylor really began as a result of my insistence on repeating a certain unsatisfactory test. This test required some forty hours of continuous application. Mr. Taylor was always on the lookout for traits in others which embraced this principle of carrying a thing through to its conclusion.

It was always his plan to establish system even in details. He would say, "If a belt breaks once, it is excusable. If the same belt breaks again from the same cause it is absolutely inexcusable. A routine plan of inspection or repairs should have been adopted to prevent the second break." And is not this one explanation for his various accomplishments? His numerous patents, his exhaustive researches, his individual attainments in many fields, all had the express purpose of overcoming some practical difficulty by improving the method so as to prevent recurrence.

This energy and thoroughness characterized his services as general manager of two large sulphite pulp mills, one of them in Maine and the other in Wisconsin, during the years 1888 to 1893.

He was selected for this position when in Midvale by a group of capitalists who, as government officials in the War Department, had noted Mr. Taylor's accomplishments in the manufacture of war materials at Midvale. In the construction of the mills he introduced large quantities of special machinery which he designed himself. Here, as elsewhere, he considered not the question of whether a certain thing had been used before, but he was always seeking out a method or a machine which would accomplish the work in hand regardless of precedent.

In one of the pulp mills he applied piece work to all the complicated operations of manufacture by his method of elementary rate fixing, and this resulted within 18 months in doubling the output.

Leaving this company in 1893, he devoted his time for the next ten years to the introduction of book-

keeping and of management methods into various plants in the East and Central West.

This period, from the time of leaving Midvale until he completed his work at South Bethlehem, was in a sense the most important of his life. During this time, as a result of his practical contact with managers and workingmen, he developed the principles which have been designated and accepted as scientific management.

Coming from Midvale, we recognize the competent, hustling, able, inventive engineer. In his notable paper, "A Piece Rate System," read before the Mechanical Engineers in 1895, we find the first presentation of what he then termed "elementary rate fixing," that is, the determination of the proper time for doing a piece of work by unit time study. But we find in this paper scarcely a reference to the broader subject of management or scientific standardization.

In his paper, "Notes on Belting," however, presented two years earlier, in 1893, the principles of standardization and of scientific research are clearly brought out in the development of definite laws, and of a definite system for handling the complex problem of belting — the adoption of the scientific method — the method which eliminates from a test all variables but one, the method which develops a problem step by step until the attainment of definite laws.

The principle of unit times, which is now recognized as forming the basis for the accurate analysis of labor operations, was completely developed while at Midvale. During that same period also were made

the belting tests and the beginning of various other researches aiming toward standardization of methods.

Not, however, until the publication of "Shop Management" in 1903, is seen the development of the complete system based not on theory, not on opinion, but as a result of this broad experience in operation gained by his contact with manufacturing plants all over the country.

In other words, he discovered as a result of his work — a fact probably not yet fully appreciated even by some of you here to-day — that, in order to carry on these fundamental principles of elementary rate fixing, of unit times, there must be embraced a comprehensive plan of organization, a plan which includes the establishment of functional management, with its planning, its routing, its inspecting, and its training of employees, and above all, with its scientific analysis of labor and machine operations for the purpose of standardization of materials and methods.

As I said, at the beginning of this period we have the able engineer: at the close of this period we find the scientist, the man who has worked out, years in advance of his time, the application of science to the cutting of metals and the application of science to industrial management.

In 1894, while he was engaged in this introduction of management methods, Mr. Taylor proposed that I take up with him an analysis of work in the building trades with a view to publishing unit costs of various kinds of construction work. This has resulted in the publication of the books "Concrete, Plain and Reinforced" and "Concrete Costs," and

material for other works on earthwork, carpentry, etc., is nearly ready for publication.

In this writing of books we find the same fidelity to standards. He made up his mind as a result of examination of facts that a thing should be done in a certain way, and in that way it must be done. While Mr. Taylor did comparatively little in the direct preparation of these books, their success is due to Taylor principles. Adopt standards — present simple, clear-cut conclusions — give conclusions at the beginning of every discussion. And it is interesting to learn that these principles are being accepted at the present time in engineering reports and technical writing as a result of a precedent thus established.

At the time of beginning this work I made my first visit to Mr. Taylor's early home — a quiet mansion located on Ross St., Germantown. I had the great privilege of meeting his father and mother, an accomplished gentleman and a gentlewoman of the type rarely met with in the younger generations — in a home where the refinement of the family life was marked. It had been the desire of these parents to give the son in his young days a broad education. He spent three years, from his thirteenth to his sixteenth year, in Europe, traveling and studying music, art, and language. It is suggested that his acquaintance with the beauties of the Alpine passes developed a love of nature which found expression in his design and layout of the Boxly Estate.

It was during this association with him that I came to understand his real character. Before this I was a little in doubt as to what was the real Taylor —

whether he was essentially the taskmaster that he sometimes appeared, that he seemed to be when he would require the attainment of the apparently insurmountable, when he hauled us over the coals as man never did before. But I soon learned to distinguish the man himself from certain qualities that were not really traits but were simply acquired by him in his usual thorough and scientific manner because he saw that at certain times and under specific conditions a special plan of action, a special policy, a special manner of speech was necessary in order to train his subordinates or in order to accomplish his purpose. Always underneath was the generosity, courtesy, tenderness, loyalty to friends and subordinates, readiness to appreciate and commend, absolute fairness. He went into everything he undertook a little farther — often immeasurably farther — than anyone else had gone before. As one of his Midvale associates said to me, "Taylor is all right except that he is a generation ahead of his times." That remark was made more than twenty years ago, and the industrial world is gradually growing up to the level then already attained by him.

Throughout my association with Mr. Taylor that which stands out most clearly is the definite accomplishment of purpose, not by brute force, not by the temporary and physical means of sheer weight or numbers, not of the type of ability which built the pyramids, but of the type which produced the accurate mechanism of the watch — the adherence to the scientific method, the appreciation of the establishment of standards.

BY LOUIS D. BRANDEIS

AMIDST our rejoicing over the achievements of this great man comes one regret. Those for whom he labored most, the working people, are not represented at this meeting.

It was Taylor's purpose to make the laborer worthy of his hire; to make the hire worthy of the laborer; to make the standard of living and the conditions of working worthy to be called American. The American standard of living implies a wage adequate for proper housing and food and clothing, for proper education and recreation, and for insurance against those contingencies of sickness, accident, unemployment, premature death or superannuation, which fall so heavily upon the working classes. That standard implies hours of labor sufficiently short to permit those who work to perform also their duties as citizens and to share in the enjoyment of life. That standard implies postponement of the working period to an age which enables the child to develop into a rounded man or woman. That standard implies working conditions which are not only consistent with the demands of health and safety, but are also such as may make work for others what it was for Taylor — the greatest of life's joys.

Taylor recognized that in order to make such a standard of living and of working attainable the productivity of man must be greatly increased; that waste must be eliminated, and particularly the waste of effort which bears so heavily upon the worker. And yet the man who sought so to develop industry as to enable labor to reach these higher standards of working and of living met, throughout his life, widespread opposition from those whom he sought particularly to help. Let all who are undertaking to carry forward his work recognize this hostility as a fact of fundamental importance; for it presents the main problem which confronts scientific management.

The causes of this hostility are twofold:

First: Only a part of the necessary industrial truths have been as yet developed.

Second: The necessary assent to the application of these truths has not been obtained.

Taylor was a great scientist. He established certain truths, fundamental in their nature. But he obviously covered only a part of the field of inquiry. The truths he discovered must be further developed and they must be supplemented by, and adjusted to, other truths. The greater productivity of labor must be not only attainable, but attainable under conditions consistent with the conservation of health, the enjoyment of work, and the development of the individual. The facts in this regard have not been adequately established. In the task of ascertaining whether proposed conditions of work do conform to these requirements, the laborer himself should take part. He is indeed a necessary witness. Like-

wise, in the task of determining whether in the distribution of the gain in productivity, justice is being done to the worker, the participation of representatives of labor is indispensable for the inquiry which involves essentially the exercise of judgment.

Furthermore, those who undertake to apply the truths which Taylor disclosed must remember that in a democracy it is not sufficient to have discovered an industrial truth, or even the whole truth. Such truth can rule only when accompanied by the consent of men.

We who have had occasion to consider the hostility of labor leaders to the introduction of scientific management know that the hostility has in large measure been due to misunderstanding. Much of all the waste which Taylor undertook to eliminate has no direct relation to the specific functions of the workingman. It deals with waste in machinery, in supplies, in planning, in adjustment of production and distribution — matters in which changes cannot possibly affect the workman injuriously. And yet we found in many leaders of labor undiscriminating opposition to the whole of the so-called Taylor system. But even if we succeed through education in eliminating the general hostility to the introduction of scientific management in departments of the business which do not directly affect labor, there will remain a wide field where the proposed changes do directly affect labor in which there is determined opposition. This opposition can be overcome only through securing the affirmative coöperation of the labor organizations. In a democratic community men who are to be affected by a proposed change

of conditions should be consulted, and the innovators must carry the burden of convincing others at each stage in the process of change that what is being done is right. Labor must have throughout an opportunity of testing whether that which is being recorded as a truth is really a truth, and whether it is the whole truth. Labor must not only be convinced of the industrial truths — which scientific management is disclosing — but must also be convinced that those truths are consistent with what may be termed human truths. Is the greater productivity attained clearly consistent with the health of the body, the mind, and the soul of the worker? Is it consistent with industrial freedom? Is it consistent with greater joy in work, and generally in living? These are questions which must be answered in the affirmative, and to the satisfaction, not of a few, merely, but of the majority of those to be affected.

To do honor to Mr. Taylor and worthily to carry forward his work, those who are his disciples and those who may become such should recognize that they have in the solution of these questions a call upon them for patient effort no less exacting and severe than that to which Taylor subjected himself when pursuing the law of cutting of steel. Every step in the installation and the working out of scientific management calls for such coöperation by representatives of labor. The obstacles to securing it are great. Twenty-five years may be required to remove them fully. But whatever the time required to fully convince organized labor, it must be given, if our work is to be well done. The consent and the

coöperation of the worker so represented must be secured. In no other way can we attain in full measure the increase of productivity upon which our well-being so largely depends. In no other way can we secure that joy in work without which increase of productivity will not bring greater happiness. In no other way can we attain that freedom and development of the worker without which even his greater happiness would not promote the general welfare. Let us work unremittingly in the spirit of Taylor to solve the problem he left unsolved. In the solution of that problem — which in a true sense is the labor problem — the greatest honor will be done to his memory and the greatest service to mankind.

BY JAMES M. DODGE

IN life he was ready at all times to explain and to defend the ideals and inspiration he bequeathed to us, gathered from that great inexhaustible source of inspiration, the wisdom of the universe, and in these he was fearless, untiring, just, and considerate. To those seeking knowledge he was kind and fraternal; to those asking for understanding and opportunity he was generous and sympathetic; to those upon whom he bestowed his affection and friendship he was all that a man could be. No one having talked with him or seriously having inquired into his work could possibly have had the slightest doubt of his honesty and earnestness. The greatness of the legacy he left us is attested by its expanding development and augmentation in value. He gave it to us freely, without restricting clauses or perplexing codicils. The wills of men inscribed on parchment may be broken and the fancied hopes of the testator frustrated through legal quibble based upon trifling errors; but the intellectual will of Dr. Frederick Winslow Taylor, devising to all mankind the results of his lifework, can never be broken, because he has inscribed himself upon earnest, thankful, and affectionate hearts by his priceless bequests to all of us. Thus we may have no hesitation in saying, take him for all in all, "we shall not look upon his like again."

ADDRESSES

AT MR. TAYLOR'S HOME, "BOXLY,"
CHESTNUT HILL, PHILADELPHIA,
PA., OCTOBER 23, 1915

BY ADMIRAL CHAUNCEY F. GOODRICH

IT would be sheer presumption on the part of a plain sailor to add to the glowing eulogies pronounced last night on the character and achievements of Mr. Taylor by men whose knowledge of their subjects and intimate relations with him are only rivaled by the eloquence of their tributes.

Bear with me for a few moments and pardon, I pray you, the necessarily personal nature of my remarks while I touch briefly upon certain of Mr. Taylor's services to the National Government, some of which are known to but few individuals, hardly a dozen in all.

Although I had met him in 1885, it was not until 1889 that I became closely connected with him under the circumstances referred to by Mr. Thompson last evening. Out of this association grew a friendship only terminated by Mr. Taylor's death.

I venture to call it intimate, although it is quite possible that, through pride, I use too strong a term. At least it gave me the courage to go to him for help when there fell to my lot to discharge as difficult and vexatious a duty as can well be imagined. Yet this duty was of my own seeking. Why? You may well ask.

The answer is that it involved a great work and countless knotty problems which to do and to solve offered an opportunity to benefit the Navy, to which

I have devoted practically all of my life and surely all of my best thought and most earnest endeavor.

Huge as were the obstacles in the path, I felt confident that with Mr. Taylor's wise counsel and vast experience at my disposition a start at least might be made.

In 1907 I was sent to the New York Navy Yard as Commandant, to find an industrial situation which beggars description. Within the yard walls were no less than five separate, distinct, unrelated plants, each seeking to be wholly sufficient in itself. Each plant was subject to orders from one of the divisions of the Navy Department known as "Bureaux" — which avoided as far as possible even calling upon another Bureau's plant for assistance. When I say that there were five blacksmith shops, five carpenter shops, five pattern shops, five sets of machine shops, etc., and that in substantially every case one shop could do all the work of the yard, I shall have given you a glimpse at the situation. Here was a chance to effect enormous economies through the obvious course of consolidating all work of one kind under one roof and suppressing plants not actually needed.

Naturally I turned to Mr. Taylor for advice — freely given. And I may say here that I never ventured to suggest to the Navy Department any change or reform until the whole matter was threshed out between him and me.

It was some time before the first move was made, because I wished first to acquaint myself thoroughly with the conditions and not — so to speak — go off at halfcock.

At once I discovered that the time I needed for personal investigation was denied me by the absurd regulation which required all official correspondence to pass through my hands. Even the heads of yard departments were forbidden to communicate directly with each other. Soon after assuming command of the yard I read a letter somewhat to this effect: "For the information of the Equipment Officer the Naval Constructor reports that steam launch #269 is ready to receive its wheel ropes."

You see the Naval Constructor could build the launch, but the moving of its wheel ropes belonged to another department.

I called in my chief clerk and asked why in thunder the Naval Constructor was bothering me with such piffle, "why did he not notify the Equipment Officer direct?" "It's against the regulation of the Navy and of the yard, sir," and such was the fact.

So I came over to Boxly, told Mr. Taylor of this preposterous, inconceivable weaving of red tape, and asked him how I could cut it. He replied that the head of an industrial establishment should never even see the trivial or routine things — that nothing but the unusual and exceptional should meet his eyes — or questions of extreme importance, etc.

After more talk and after receiving invaluable hints, back I went to New York and issued an order that "as an experiment" all subordinates under my command should communicate directly with each other on matters having my approval, but that they were forbidden to initiate new subjects without my knowledge and consent. The effect on my labors was instantaneous and immense. The experiment

roved a great success, and when reported to the Navy Department its methods were adopted for the ntire service.

It thus came to pass that from having to sign my ame from three hundred to eight hundred times a ay on wholly perfunctory indorsements, chiefly "Respectfully forwarded," about forty times were ound to suffice, and these signatures were to docuents that required my careful consideration.

Thus were the chains that bound me to my desk hattered and opportunity afforded me to go around he yard and investigate conditions and methods.

The nation was fortunate during this period in aving at the Navy Department, first as Assistant nd then as Secretary of the Navy, the Hon. Truman H. Newberry — a man of extensive business xperience, clear mind, and exceptional courage. Mr. Newberry welcomed any and all suggestions for he improvement of affairs at the navy yards with vhich he was especially charged, and with singular delity to the public good he ignored the protests f the politicians, who loudly complained of the work f navy-yard reform, and he furnished that indisensable factor, departmental authority, without vhich nothing could be done.

It is only fair to say that Mr. Newberry himself nitiated a number of reforms — only one of which, owever, was not preceded by a conference with ne. This exception was due to a kind and generous onsideration. He foresaw that it would occasion iolent opposition and recrimination. These he ought to take to himself, thus sparing me from ttack.

And I should also remark that he knew of my close relations with Mr. Taylor, having been assured by me that I would propose no scheme to him that had not been previously discussed between Mr. Taylor and myself.

Out of the countless instances that might be quoted I will only mention one to illustrate the value of the latter's advice.

One day there came to my office a printed schedule of the quantities of tool steel required for the ensuing year *in but one department* of the various navy yards. A certain yard alone, by the way, asked for over forty tons of this material. This will give you some idea of the total amount for all the yards.

I noticed that each yard demanded a particular kind, mentioned by brand. Using fictitious names, let us say that Portsmouth wanted "Ajax," Boston "Acme," New York "Alpha," and so on down the line, each certifying that none other would suffice. At once I posted over to Boxly and explained the case. "You are paying for a brand — not for the steel," said Mr. Taylor. "Make your own specifications and open the bids to all manufacturers." To make a long story short, I suggested to the Navy Department that a "Tool Steel Board" should be formed to go into the question. My recommendation was adopted. Through Mr. Taylor's help the Navy began buying its tool steel — not by brand but by its own specifications. The very first purchase of high speed tool steel brought the price down from $1.25 a pound to thirty odd cents; and the Commandant of the Washington yard, with its

great gun shops, informed me that the new steel did one-third more work than the old.

Mr. Taylor's independence is to be seen in this episode. He was summoned to Washington by one of Mr. Newberry's successors and asked to help improve matters. As he did not like or admire this official, he told the latter frankly that he was ready to do everything in his power to further the interests of the *Navy*, but that was his only motive, since he refused point blank to be considered as anxious to contribute in any way to the success of that gentleman's administration, something in which he had no interest whatsoever.

I tell this story to illustrate Mr. Taylor's absolute integrity in both thought and deed.

He would not permit any incorrect inference to be drawn from his willingness to serve his country. He could not lie, and he hated a liar with a hatred expressed in his own picturesque terms.

To those fortunate individuals who won his esteem and confidence he gave freely from the rich treasury of a rare nature, exceptional ability, and, vast experience.

Gladly do I acknowledge my own indebtedness in these respects.

I regard it as a blessed privilege to be able to count myself among the close friends of Frederick Winslow Taylor.

BY HAROLD VAN DU ZEE

I HAVE been asked to talk a few moments on the very unusual and remarkable experiments on the cultivation of red fescue grass that Dr. Taylor has carried on here for several years, and in which it was my privilege and good fortune to assist.

Some thirteen years ago Dr. Taylor purchased these grounds and at once, in his usual thorough way, began planning the home you now see, with every detail well adapted to the normal enjoyment of his family and friends.

Among the things thought desirable was, of course, a putting green, on which to improve an already well established skill. Now the making of a putting green was not, at that time, thought to be a task of unusual scientific difficulty, so ordinarily well used methods of soiling and cultivation were used in the full expectation of a satisfactory green.

The green could not be used the first season,— it was too tender. The second season it was still tender, and the third season it had failed badly in this severe climate.

For several years Dr. Taylor worked with all his ingenuity to make the green a success. The injured places were cut out and refilled with a different soil, then seeded with much care. At another time, when the grass seemed below par, holes were punched with a steel dibble and filled with bone

meal, topped with a germinating mixture. Other carefully thought out efforts were made to get good grass. All these repairs were carefully watched, but the watching did not help, and it became apparent that all the ingenuity was going into the grass and none to putting.

You who have been intimate with Dr. Taylor will understand that when something was found that could not be done, that was the very thing that *would* be done and, moreover, every one would help do it. You all are familiar with the history of the slide rule. Here, when these grounds were purchased, was a large quantity of box hedge over a hundred years old, but in a very untidy and useless condition. If this could be transplanted into an orderly design for a garden, it would be a prize. Experts declared that no efforts to transplant would succeed; intimate friends made sport of the idea — money thrown away and all that. Yet eleven hundred feet of the box was transplanted without losing a bush, and you all have seen the result.

It seemed that making a satisfactory putting green had become another of the things that could not be done. So with the failure of the efforts at repair began a work that grew to a long series of unusual and interesting experiments to make grass of fine quality grow in this unfavorable climate. There came a fixed determination to learn how to make a putting green that would satisfy the most exacting requirements of any golfer, and at any season. And Dr. Taylor began planning a series of tests for an investigation of this baffling subject.

I shall never forget from how simple a basic

statement has grown an unfinished work covering several years of unceasing effort. Dr. Taylor's first explanation to Mr. Bender and myself was that grass needed nourishment, root space, ventilation, and moisture. For the best meeting of these four requirements there have been carried out many hundreds of growing tests, and thousands of tests of materials, relating to their physical properties, source, cost, etc. It is certain that Mr. Sanford E. Thompson had a lively time in his laboratories during the early part of the work, and doubtless can measure his records by the cubic feet. My own files contain several pounds, and perhaps nearly a hundred plans, of tests and experiments. By this it is easy to see that even if the four basic requirements appeared simple, there was great difficulty in meeting them. Nevertheless, there was to be no stopping till they were met in some way.

A brief account of an earlier effort made by Dr. Taylor to have a putting green may serve to show what really great effort was put into the work here. In 1901, at his former home, a very rough piece of lawn was converted into a green in a somewhat novel way. It was thoroughly soaked until almost marshy; then the rough places were pounded down to a true surface with broad iron rammers. Thousands of small holes were made in this smooth surface by means of large nails fastened point down on the under side of a piece of board. The holes were then carefully filled with a germinating mixture, the green was watered regularly and fed twice a season. The result was the possession of a fair green, according to the requirements of that time.

Here at Boxly a much better grade of green was thought necessary, and the lack of success in the first years of effort became a strong stimulus to find the reason of the failure and the requirements for success.

Dr. Taylor never lost an opportunity to inquire into any interesting turf, wherever it might be found, and several times brought here samples of particularly fine turf from other parts of the country, replanted them here, and watched their progress and noted the interested results. They were mostly negative, owing to the severe climate. It was afterwards determined that the fescue, a most desirable grass, was best suited to a cool climate and would not thrive as some of the other grasses in this particularly hot and often humid atmosphere. This conclusion was accepted only after a long series of tests in great variety.

The very fact that the red fescue was a difficult grass made it all the more interesting to find out how to grow it successfully, hence the perseverance. Dr. Taylor's discussion of his results and conclusions have been published in the *American Golfer*. So I shall give only an account of what was done.

In 1909 forty-two germinating experiments were started to discover the best way to germinate seeds and to sustain the early growth of the grass. In planning the tests each test had one condition of soil different from any other, and records were kept of the entire soil construction and of the progress of the growth. By the term "soil construction" is meant the physical composition, the kinds and proportions of materials, the thickness and depth of the different layers, etc.

Dr. Taylor considered that the ordinary term "soil" could mean anything from a rich swamp muck to a barren hillside surface, and therefore was not a precise term in any sense. For the same reason it was decided that no soil in the ordinary sense could be used, because it could not be reproduced readily at any time or place, and unless a successful soil could be exactly reproduced successful results could not be duplicated. A full appreciation of these facts led to the construction of soil with standard materials that were to be obtained anywhere with fair assurance of uniform quality, making possible indefinite duplication.

This consideration led to prolonged efforts to find materials that would be uniform and could be easily obtained in indefinite or unlimited quantity. Many of the materials used in the tests were found only after long and persistent hunting, and were either not available at first or not known. Among these were bar sand, Jersey peat, cow manure, cracked bone, sands from New England, leaf mold from the local woods, swamp muck, many sizes of gravel, and fine stone. Every material had to be tested to show its physical characteristics, much in the way sand is tested for use in concrete or filtration work. Knowledge of the physical qualities was used to determine the amount and position of each material in the solid composition.

One interesting quality of the different materials was the power of lifting water from a free supply at the bottom to considerable heights by capillary attraction. The difference in height came from a difference in the size and shape of particles of the

materials, mostly sand, and the proportion of the different sizes in the material. Some sands would lift the water but little more than an inch, others would lift over thirty inches. The high lifts took a long time, and, as might be expected, the amount at the top would be rather small. This water-lifting power was investigated carefully in hundreds of ways, as it was to be used in experimenting with an exactly controlled supply of water in an elaborate series of tests.

It will now be seen that all of the four requirements first mentioned are provided for. A novel plan for study of these four requirements was carried out in the fall of 1909. It consisted of a concrete basin about fourteen feet square and sixteen inches deep, placed in one corner of the putting green. This was so arranged as to bring the finished work into the regular surface of the green. The basin was built with small reservoirs to hold water and with drain outlets at different heights to control the depth of the water in the soil. These outlets were visible. One half of the basin, separated from the other half by a concrete partition, was to hold the water at a high level, and the other half was to hold it at a low level. At a low place in the surface of each basin was provided an inlet by which the rain water or sprinkler water could reach the reservoirs. In the soil construction means were provided for drainage of surplus water. In this basin, although only thirteen by fourteen feet, were first placed test constructions for over a hundred different experiments.

As the scheme of test construction has been the

same throughout the entire work, it will be outlined here.

It was considered that the growth of the grass from the seed to full maturity might be aided by suitable changes in soil for different depths of rooting. Therefore the soils were constructed in layers of predetermined thickness and position, there being from four to perhaps a dozen layers of soils in a test. Some of the thicknesses would be $\frac{1}{8}$ inch, and from that to twelve inches. Where a series of conditions were to be tested, some of these layers were laid in strips, with an upper strip crossing a lower one, on the gridiron plan. This simplified the construction and helped to systematize the work. In this way one experiment would cover the area of one crossing of the strips, and these areas were, of necessity, small. It was unexpectedly interesting to note that the grass was very sensitive to the influence of the soil, so the lines of the divisions would keep clearly marked where soil changed from good to bad. But in many cases the quality of the different soils used varied so little that the grass was often of uniform quality over several areas.

The materials used in the soil construction for this basin included crushed stone, gravel, broken glass, agricultural lime, four different forms of nourishment, and seventeen different sands. In arranging these, nothing was taken for granted. Positive knowledge of the fineness or size of soil particle, the voids, and water-lifting capacity was used in the selection, and the materials, either simple or mixed, were placed in positions that seemed interesting for each test. By this selection and arrangement were

provided means by which the water could go up, and by which it could go down, freedom for the roots, places where they could go for moisture, and where they could go for nourishment.

It was impossible to avoid the feeling that in carrying out these extensive experiments, Dr. Taylor had a sort of unconscious joy in putting shop methods to work. There was the precise classification of materials, precisely measured proportions, an accurate percentage of water to be applied to the dry materials. It seemed as if he constantly kept in mind a routing plan for the roots and for the water. There were provisions for the young roots, provisions for the middle-aged roots, and for the mature roots, and doubtless the roots were more happy than if left to themselves and enjoyed greater luxury than grass ever had before.

And what was the return for all this on the part of the grass? Much of it failed to thrive through the hot weather, while some did fairly well. Many of the failures were satisfactory, because they eliminated certain combinations. Dr. Taylor often expressed a wish that not all tests should prove satisfactory — there would be so little to learn. As a matter of fact Dr. Taylor derived much information, a part of which has been published, and discovered valuable combinations and some unusual materials, many of which were brought in by the carload.

The germination of the seeds was fairly startling. In the early tests a quart of seed would be mixed with four quarts of prepared soil and the mixture would be spread over the surface in a layer $\frac{3}{4}$ inch thick. This quantity of seed, if evenly spread

without soil, would make a layer about .17 inch thick. Later discoveries led to the mixture of one quart of seed to 2500 quarts of the prepared soil, so the resulting germination would show about 6 to 10 spears of grass to the square inch, and in the case of the creeping bent this seemed to give the best results. It is estimated that there are 300 million creeping bent seeds to the cubic foot and about 11,700,000 to the quart, so it can be seen what a vast number was used in the early work in excess of what was needed. The early practice would take about 50 bushels to 1000 sq. feet and the latter would use but $\frac{35}{100}$ quarts for the same area, or 15 quarts per acre. The seed men do not approve of the latter method.

The different materials were rarely found easily and at low cost, and much hunting was done. When the desired material was found it was very likely to be in unsuitable shape for use; then came a hunt for the machinery to bring it into condition. Dr. Taylor was much pleased at the discovery of agricultural machinery for this work, and machines were finally found that served for mixing, for cutting, for grinding, and for shredding, at relatively low cost. Ten to twenty horse power gasoline engines are needed for this work.

A somewhat different line of effort has been interesting. Dr. Taylor learned of some remarkable sod in Southampton, Conn., and we made an inspection trip in April, 1911. The sod was so very attractive that Dr. Taylor purchased it as it was, a special strip containing nearly 2700 square feet of fine fescue. This sod was cultivated in an unusual way by Mr.

Olcott, who at one time was editor of the Hartford *Courant*. The Olcott method was to expand a sample sod to occupy about seven times its ordinary space by cutting it into blocks 2 inches square and planting these in square holes of a well worked soil spaced 7 inches from center to center. The bare soil between was kept entirely clear of weeds, and in two or perhaps three seasons a fine firm turf covered the entire area. On this experimental sod garden were grown probably the finest specimens of turf in the world, and the specimens used came from as far as China and Japan. The turf so expanded was expanded again in the same way, with a like result of fine turf.

Dr. Taylor transported nearly fifteen hundred square feet of this turf in two carloads, and placed it on this forecourt and on the sod garden here. Much placed in the sod garden was expanded by the Olcott method to cover about seven times its original area, and the present turf in the corners of the forecourt was taken from this cultivation of his garden. The two carloads were brought from the Olcott farm in 1911, at the end of the dry season, about the last of August, and the turf expanded from this was planted in the forecourt in September 1913, —a very successful two years' expansion.

A striking incident occurred in this sod transaction that illustrates well Dr. Taylor's clearness and steadiness of mind. It was decided to take up the sod during the latter part of August, and when we went to inspect it during the summer, we found that it had turned white and looked really dead from the very severe and exceptional drought of that

season. In spite of this Dr. Taylor never expressed the least hesitation or regret or fear of the result, and the operations for the transportation continued as though the turf were in the most flourishing condition. Most people with so expensive a project on hand would have hesitated to proceed, tried to reconsider, or attempted some strenuous and perhaps useless remedy. Not so with Dr. Taylor. Somehow he felt sure he was safe and right, and the result proved him right. This faculty of knowing things correctly is doubtless one of the secrets of his success in achievement.

LETTER FROM WM. A. FANNON

IT was on a bright Sunday morning in 1884, probably June, that I first met Mr. Frederick W. Taylor, of Germantown. He was then Chief Engineer of the Midvale Steel Co. at Nicetown and he wished to have Mr. Charles W. Shartle, now of Middletown, Ohio, and myself come into the Midvale employ and assist in working out his new system of management. If for no other reason, his proposition, presented with force and enthusiasm, had us mightily stirred, so that we talked of nothing else on our way home.

I had had personal experience with piece-work as a boy. And again, just prior to my meeting Mr. Taylor, my fellow workmen and I had had our rate cut as a reward for getting out a large production and showing others how it could be done. This rate-cutting evil was general at that time, however, and was due to setting the rate *per diem* on insufficient data. So with this well in mind as a concrete illustration of the ill-effect of the old piece-work or *per diem* system, Mr. Taylor's scientific method of getting data before establishing a rate per diem appealed to us. Added to this was his idea of not only one rate per diem, but several, which might be called accumulative rates.[1] His methods seemed

[1] [Differential rates, ED.]

to us an insurance against the employer's having any reason for cutting rates and also against the employee's earning a compensation out of all proportion to what the employer could afford to pay or inconsistent with the earnings of other men of equal or similar skill in the plant. And the confidence that must exist between men in business transactions which this careful rate setting engenders was also reflected in Mr. Taylor's personality and won us over to confidence in the practical working out of his proposition.

So Mr. Shartle and I entered the employ of the Midvale Steel Co. on July 1, 1884. Mr. Shartle was given (at his choice) the erection of new machinery and repair work, commonly known as bench work; and I, the running of a slotting machine which was, besides doing miscellaneous work, cutting out test bars for the United States Government. On this machine I assisted in getting out data not only for making future *per diem* rates, but also facts from actual practice concerning cutting out test bars from ordnance steel. Mr. Taylor seemed to think that there was a future in selling ordnance to the government and was very desirous of getting such notations. My work was under a stop watch which was in constant possession of a man known in his official capacity as an observer.

I continued with Midvale in this line of work until May 9th, 1887, or approximately three years. Prior to my leaving, Mr. Shartle had gone to his home in Middletown and had organized a company of his own. I followed and joined him in the business in June, 1887.

During this period that I had been with Midvale, I had seen many interesting developments of Mr. Taylor's system. Prominent among them was the turning of steel axles for railroad service on Pullman and other cars. Prior to Mr. Taylor's starting his system for compensation for the turning of axles, men were paid $1.50 for ten hours' work and a day's work was considered approximately three axles. With his system of accumulative compensation and a rate based on scientific data, the men were earning about twice as much as they had earned before for the same number of hours of work, and were producing from two to three times as much. Approximately the same results were brought about in the turning of tires for locomotives, Pullman, and other cars. The development of splicing and of keeping proper tension on leather belting was also forwarded to a very satisfactory degree.

After I had been in Middletown, Ohio, for some years, my health failed me, so that I went to Colorado. I was there about six months; and while there I received a letter from Mr. Taylor stating that indications pointed to considerable expansion in the Midvale Steel Co. and if I thought of coming back East at all, he would like me to return to that organization. Later, during a visit to my brother in Philadelphia, I saw Mr. Taylor and I reëntered their employ on February 11, 1889. During this latter period I again saw that Mr. Taylor was progressing with his system so much that it increased my confidence in him and his efforts and I decided to remain and tie up with the Midvale Steel Co. I became very much interested in all the progress

was being made in all the departments. It was
ıt this time that I married.

mong his achievements during this second period
I was with the Midvale Steel Co. was the design
new steam hammer. It was a well known fact
o that time, that the design of all steam hammers
been along certain similar lines. This design
such that, the hammer being in a rigid frame,
ould in time, through the jar of operation, crack
break up the frame of the hammer itself. There
also the need of a hammer capable of working
ings of a larger size than had hitherto been
mpted. So, in order to build a more durable
mer, and one which would overcome this serious
ct of the rigid frame, Mr. Taylor designed one
ch was unique in its plan and flexibility. It was
lar to great jointed spider legs, and it had a
tch and recoil like a spiral spring. With the
on and head, this hammer weighed twenty-five
; and, when the steam was let into the cylinder
top, it struck a blow of seventy-five tons. Al-
ıgh the hammer was not established when I left,
information was that it effected a tremendous
ng in repairs and was a complete success. Sub-
ıently, makers of ordnance substituted hydraulic
ses for steam hammers, but the designing of this
mer was a bold piece of engineering and re-
ed great courage.

understand that Mr. Taylor also designed some
ial tools for turning and machining large forg-
which are unique and successful.

uring this latter period, the progress of the Mid-
Steel Co. was such, especially in Mr. Taylor's

department, that the then Secretary of the Navy, William C. Whitney, became interested in Mr. Taylor's unique and unconventional progress and asked Mr. Taylor to come to Washigton, D.C., for a conference.

Some time prior to this conference, a Mr. Thilmany came over from Germany and succeeded in interesting Don M. Dickinson, then Postmaster in Detroit, in a new process invented by a German chemist, Professor Andrew Mitterlich, for the conversion of wood by-products into fiber suitable for the making of paper and other products such as shoe boxes and container boards. Mr. Thilmany had in mind principally the utilization of the slabs, edgings, sawdust, and bark that were being produced in the manufacture of lumber from saw logs. And indeed the accumulation was such that there were endless conveyors carrying this waste material into large burners, not only without getting any returns but at a certain cost for the maintenance of these burners.

Michigan was a great lumber-producing state, and Mr. Dickinson was acquainted with a number of lumbermen who were aware of this tremendous waste and this process for the conversion of it. Through him they became interested to such an extent that they paid Mr. Thilmany a large sum of money for the patent rights for this process in America. Then they organized a company known as the Manufacturing Investment Co. of New York, having for some of its stockholders: Col. O. H. Payne of New York, William C. Whitney, Daniel Lamont, and Don M. Dickinson. At the time Mr.

Taylor was asked to the conference in Washington, they had already started to erect a plant in Madison, Maine, and in Appleton, Wisconsin, and Mr. Whitney was looking for a general manager. His duties were to be, — first to look after the welfare of these two mills, and, after these were properly organized and running, to erect mills in different parts of the country for the further utilization of this waste.

Mr. Whitney, at the conference in Washington, D.C., offered Mr. Taylor a very much larger salary than he was getting at the Midvale Steel Co. After some deliberation and consultation with some of his relatives and friends, he decided to accept the position as general manager of the Manufacturing Investment Co. and signed a contract dated May 26, 1890; and it was specified that, from that date until October 1, 1890, he should devote as much time as possible to the affairs of the company and, from October 1, 1890, until October 1, 1893, he was to devote the whole of his time to this work. He remained with the Manufacturing Investment Co. until June, 1893, which covered a period of about two and a half years.

Mr. Taylor was anxious to have some of his old time friends in the organization and spoke to several of the employees of the Midvale Steel Co. in his department about coming with him, but did not urge them. He offered me the same opportunity and I made a trip to Alpena, Michigan, where this process was in actual operation in the Fletcher Paper Co. Mr. Fletcher was a lumberman and had started up a paper mill to use the sawmill by-products and turn them into paper. After the visit

here, I returned and discussed going with the Manufacturing Investment Co., but Mr. Taylor and I did not at first agree on salary. The possibilities seemed to be unlimited in this new business and I learned from Mr. Taylor that there were many young men so eager to get into this business that they were working for a while without any compensation whatever. This was one of the arguments for combating my ideas of what salary I thought I should have to break up my home and enter into an entirely new business in a new country. My reply was that he might be able to get those young men but I was not in that class and I would have to have the salary that I stated or I did not feel that I should go with him; but, if he would pay me that salary, he would get the best that was in me. After a couple of weeks' time, he decided to accept my ideas as to salary and I decided to go with the new company and left the Midvale Steel Co. on the 8th of January, 1891. I remained with the Manufacturing Investment Co. until it was reorganized in 1899 and changed hands. It is now known as the Interlake Pulp & Paper Co. In the reorganization, the Madison, Maine, mill, divorced from the Appleton Mill, was absorbed by the Great Northern Paper Co. The Interlake continued to operate and is operating at this time with the writer as Vice-President and Manager.

During Mr. Taylor's incumbency as general manager, he established some features of his new system, although this industry did not afford the same opportunity in detail for the development of the new system which other lines of manufacturing offered.

These features were in vogue for many years, lasting until changing conditions eliminated them.

Mr. Taylor had hardly taken hold and gotten the organization permanently started before we discovered that the enterprise was to be very largely a disappointment. First, the price paid for the patents was a large one in view of the fact that they did not prove to be as much a controlling factor as had been anticipated. When the company bought these patents, they believed that all other companies wishing to cook wood in a digester would have to pay the Manufacturing Investment Co. a royalty for the use of the lining to the digester, which was considered the last word in the way of digester linings and the final victory over the most hazardous part of the sulphite business.[1] Not long afterward other sulphite mills were built and operated by other people who were not obliged to pay the Manufacturing Investment Co. royalties, and a process was established and became a commercial success although the fiber was not as good as that made by the Mitterlich process. In fact an amusing suit was begun about twenty years later by a Mr. Russell of New England against the Manufacturing Investment Co. for an infringement on the New England company's patents for a lining of the digester. The suit was, however, unsuccessful.

[1] As a sample of what this problem of linings was, records indicate that in 1863 Benjamin Tilgeman, a Philadelphia chemist, took out letters patent for his sulphite process but found the problem of getting a suitable digester so difficult that he gave it up as a bad job after spending $20,000 in trying to overcome this one difficulty.

The next unfortunate experience was that, in the Company's anxiety to get these mills started, they did not take sufficient time to select the best locations, for there were other water powers that they might have secured which were far better than the ones they did secure and were equally well, if not better, located for the supply of forest products.

An additional unfortunate thing occurred. In their desire to get these mills going, there was a competitive spirit started between Admiral Goodrich and Admiral Evans as to who would get his mill first producing fiber. The Appleton Mill, operated by Admiral Evans, succeeded in making the first fiber, which was on March 15, 1891; but, in the haste to get these mills going, there were some unfortunate mistakes made in the designing of the mills by the architect or engineers, some of which were beyond the control of Mr. Taylor, as they were made before he took charge. Yet in this same rush Mr. Taylor also made some mistakes. In fact all seemed to act in an impulsive way and to contribute some to the making of mistakes, due largely to their anxiety to get started and to inexperience as to what was needed in this new process. All these things helped to make the proposition a disappointment.

Then, on top of all, they just got started right when the panic of 1893 showed in a most forcible way that the profits that had been promised by the original promoters and accepted as a fact by the organizers of the Manufacturing Investment Co. were far below what was anticipated. Indeed, it was difficult to make a new dollar from an old one.

So great was the disappointment to Mr. Taylor that I think it affected his health. He had gone far enough into this business to find that it did not appeal to him and so he rendered his last service to the company in June, 1893, and then went into the real beginning of the development of scientific management and that of high-speed steel.

As I look back upon my experience with Mr. Taylor the two times I was associated with him in the steel works and later in the Manufacturing Investment Co., the traits that stand out most prominently to my mind are: his true democracy, his exceeding cleverness, his many-sidedness, his tremendous loyalty to his friends, and his strong purpose and convictions. You always felt that you knew where he stood on any proposition in which he was interested. Indeed I often thought he would have made more rapid progress if he had been more tactful and not so willing to combat in an intense way anybody that saw fit to oppose him or disagree with his various ideas. He seemed to feel that "He that is not with me is against me."

Many people did not like him because his ideas were at least twenty-five years ahead of his time; but the fact that they could not see his purpose and ultimate ends did not make those ends impossible, although they thought so.

Sometimes, when Mr. Shartle or I discussed a proposition with him, he would act as if we had no right to oppose him or argue the matter. At the time this seemed to us rather harsh, and irritated us; but in the light of what has transpired in the last twenty-five years, it does not look quite so bad. I think he

saw farther ahead than we did, and it was not egotism that made him take that apparently arbitrary position, but the fact that he had already gone over the ground thoroughly in advance and had thought it out and come to a conclusion by which he was willing to stand. He did not see any use in wasting time by going over the same ground repeatedly. A problem once solved was not to be rehearsed again and again. We were to accept the result he had worked out and knew was right, and go on from where he left off. I never saw a man who had a greater courage of his convictions than Mr. Taylor, or one who was more willing to admit his mistakes and not blame others for them.

Another thing which impressed us was his love for work, regardless of the fact that he was not obliged to, if we properly understood his financial condition. Yet his work was of the most strenuous kind. He even went into recreation in a most strenuous way. His work, under the new Taylor System, seemed to be of the most contradictory character. He was working hard and quarreling with many people to establish a unique system the aim of which was to make a permanent peace between employer and employee, so that they would both get a square deal.

In addition to the above characteristics one, which impressed us by no means the least, was the purity of his life.

RESOLUTION

ADOPTED BY THE SOCIETY TO
PROMOTE THE SCIENCE OF MANAGEMENT
AT ITS MEETING IN PHILADELPHIA, PA.,
OCTOBER 23, 1915

Whereas, the Society to Promote the Science of Management, in pursuance of its plan to observe a fitting memorial to the life and work of its distinguished leader, the late Frederick Winslow Taylor, has been favored with the gracious hospitality of his devoted helpmate and companion Mrs. Louisa Marie Spooner Taylor; and

Whereas, the coöperation of Mrs. Taylor in this memorial has been an important and essential contribution to its proper observance; be it

Resolved, that the Society to Promote the Science of Management hereby expresses its hearty appreciation of the part taken by Mrs. Taylor in our joint rendering of due honor to the memory of her revered husband; and be it

Resolved, that this Society hereby records its confident hope that the adherance to Mr. Taylor's ideals and the helpfulness in their realization manifested by Mrs. Taylor during his lifetime, through the dark hours of its close, and to the present dedication of this Society to a continuation of that work, will continue with unabated interest and enthusiasm, and further be it

Resolved, that these resolutions be spread upon the permanent records of this Society, and that a copy hereof be duly engrossed and presented to Mrs. Taylor.

BENEDICTION

PRONOUNCED BY THE REVEREND LANGDON C. STEWARDSON AT MR. TAYLOR'S GRAVE, WEST LAUREL HILL CEMETERY, PHILADELPHIA, PA., OCTOBER, 23, 1915

A Benediction

We are gathered here in the presence of God and at the grave of Frederick Winslow Taylor that we may remember the dead and carry away with us an inspiration for the living. The spirit of our friend is upon us now: the spirit of fearless research and radical reform and love of humankind.

He lived that he might break untrodden paths of truth and labor. He could not sit content amid the errors of industrial faith or the sins of its established practice. He sought a principle which should point each worker to his appropriate task and give him opportunity to happily fulfil it. He made incessant war on waste, unfitness, incompetence, injustice. His effort was, by readjustment in the chaos of life's jumbled parts, to set things right: to bring each man to his own: and so achieve efficient toil and social welfare. He knew that to be unproductive was to defraud the community and to beggar the individual. Hence his lifelong purpose was to save men's souls, to bring them into possession of themselves and thus assist them, each in his own place and according to the honest measure of his ability, to serve their fellows and to glorify their God.

To honor his memory is to continue his work. To reverence his spirit is to spread it abroad. To make this ceremony and occasion fruitful is to leave this ground to-day in the high resolve that we too will undertake to save men's souls, to bring them into possession of themselves and thus assist them, each in his own place and according to the honest measure of his ability, to serve their fellows and to glorify their God.

Upon this mission may God's blessing rest.

Amen.